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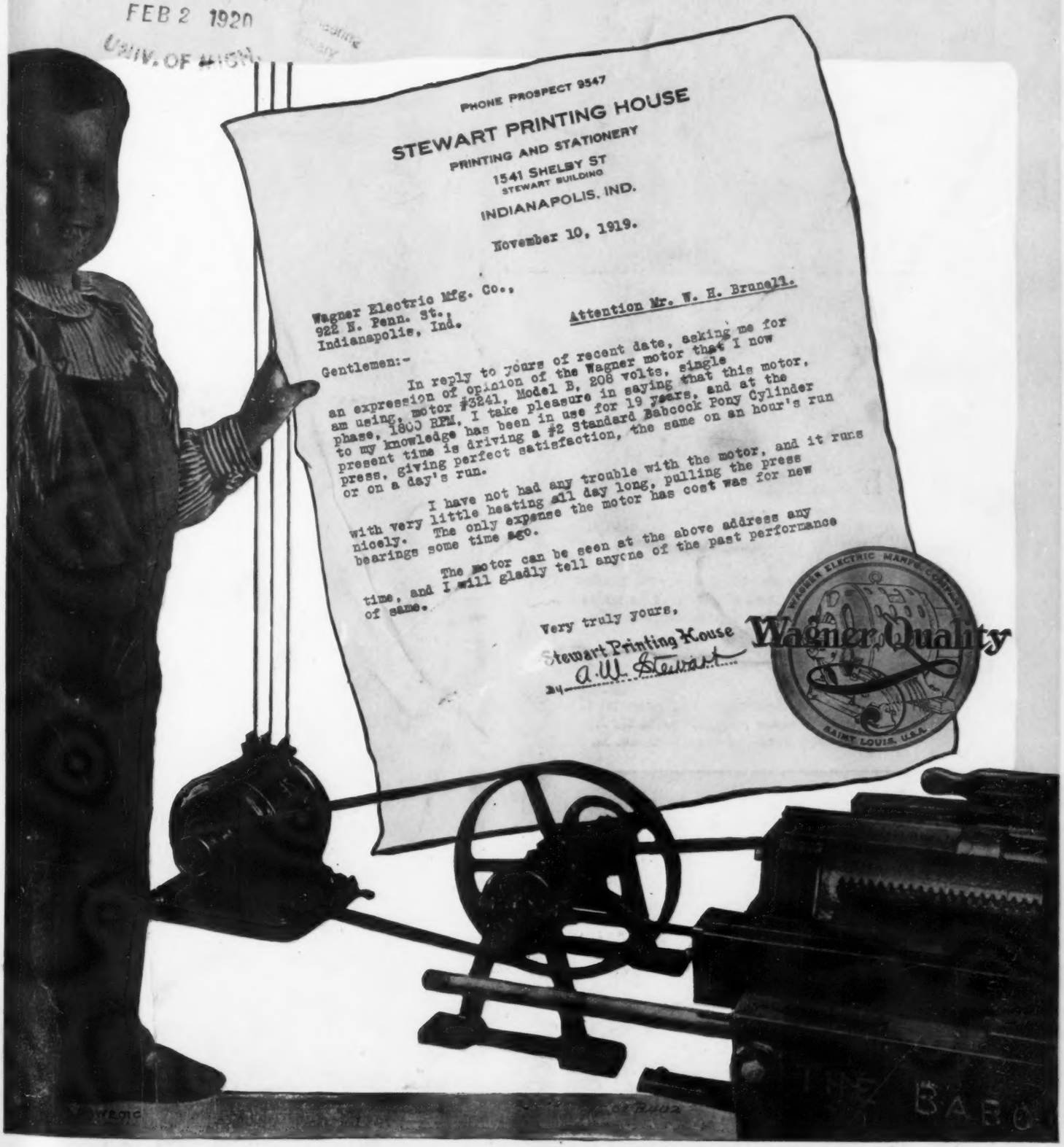
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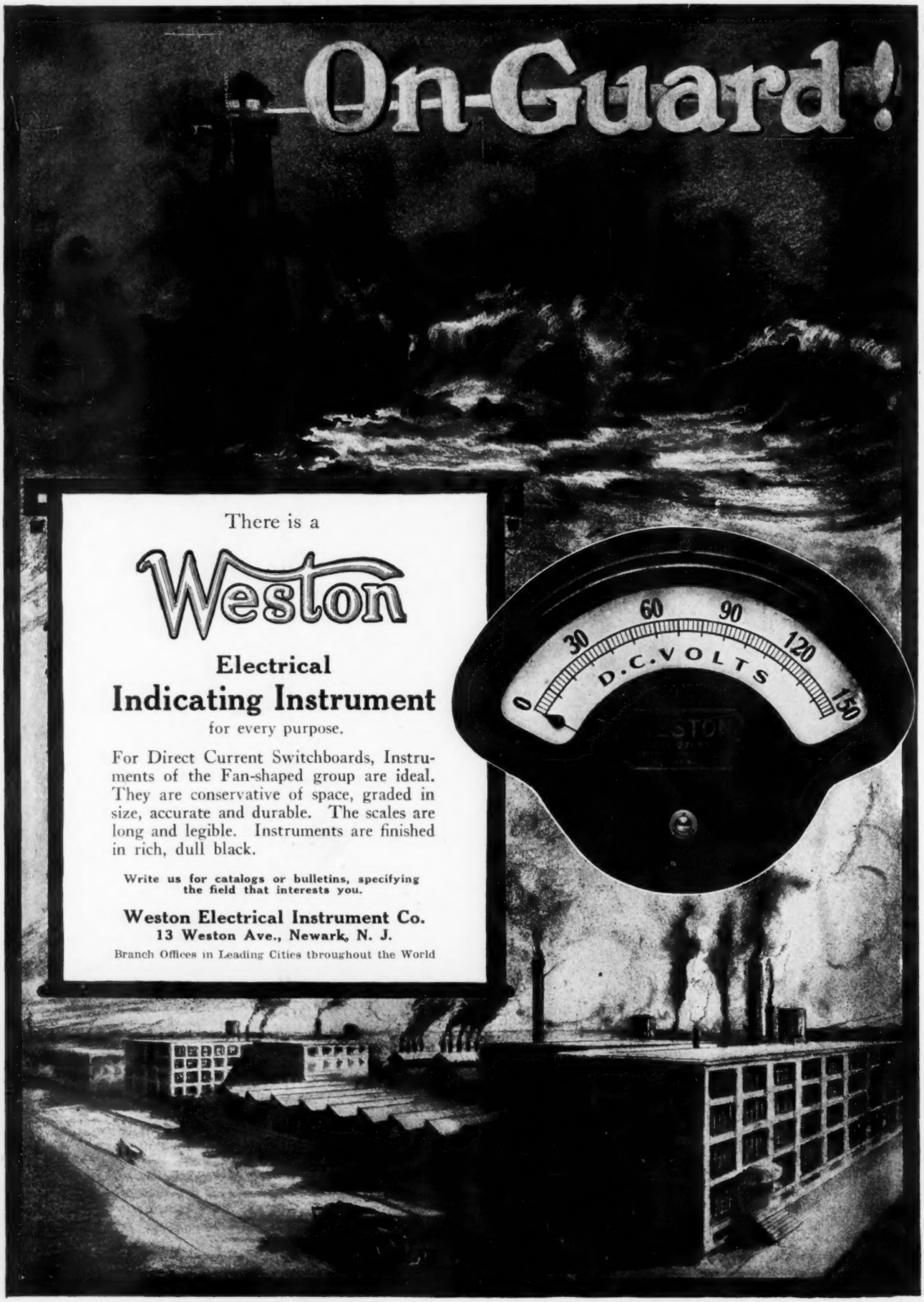
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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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The Wage Earner's Effect on Business

MUCH has been said recently regarding the daily wage earner's prosperity as compared with bygone times. Extravagance has been rather a fetish with the American public of late, and to this state of things the wage earner has naturally contributed his share. However, there is at least one healthy sign in conditions as they are at present, that being the remarkable growth of all business that helps to lighten the burdens of the household. No doubt, much of the tremendous increase in the electrical appliance trade is due to the growing acuteness of the servant problem, but when one stops to consider that most American households have always been operated without servants it seems evident that the whole answer is not there. This willingness of labor to let its unusual prosperity make the ordinary burdens of the family lighter is commendable, and while extravagance in the purchase of luxuries will eventually decrease, it is very doubtful if the housewife will ever again be content with the old methods. It is, therefore, to be expected that legitimate lines of business dealing with necessities will continue to flourish, and the electric appliance trade is now in that class.

The modern electric central station is a monument to the engineering skill and foresight of the engineer, but the quality and continuity of service rendered to customers depend largely on the training, efficiency and fidelity of the men who constitute the operating organizations of the industry.

Utilizing Poor Coal

WE HAVE published from time to time various papers dealing with the utilization of low grade fuel, a subject which is daily growing in importance, as the miners are subject to more and more dissension and transportation grows more difficult and uncertain. In the issue of the ELECTRICAL WORLD for Jan. 10, page 68, a study by E. H. Bull gave characteristics of the coal mined in Montana and Wyoming. These mines are of the sub-bituminous class, rather high in ash and in moisture and rather low in calorific value. In mining these coals quick ignition is needed and the matter of ash discharge demands great attention. The earlier attempts were only moderately successful owing to failure properly to meet these conditions. In going into the matter in a practical way, Mr. Bull finds that excellent results can be obtained by the use of a rather fast running chain grate with a long and steeply pitched arch to obtain the concentration of heat at the stoker gate used for quick and thorough ignition.

As in burning other low-grade fuel, a combustion chamber of liberal size seems to be highly desirable. The necessary thickness of fuel bed and speed of chain grate vary somewhat from coal to coal as might be expected, but the same general principles hold good for all. In trying out on experiments three varieties of this sub-bituminous coal, Mr. Bull found it possible to get an over-all efficiency of approximately 75 per cent with development of roughly from 175 to 200 per cent of the builder's rating of the boilers. This overload capacity seems to be limited by the volume of the furnace as might be anticipated from the nature of the fuel. These results are highly satisfactory as pointing the way to successful use of these valuable but rather troublesome forms of coal. The secret seems to be in skillful adjustment of the combustion and liberal room for completing it. Given these, a properly constructed chain grate will do the rest, and the fuel proves economical in many situations where the cost of high grade steam coal would be well nigh prohibitive.

The inefficiency of labor is due not so much to the deliberate loafing of employees as to their unfamiliarity with the particular work they are doing. Many workmen have been too unsettled to stay long enough at any one job to become skilled.

Extra-High-Voltage Lines

THE interconnection of the San Joaquin Light & Power Corporation's system with that of the Pacific Gas & Electric Company now in the process of construction at Newman, Cal., involves a 20-mile (32-km.) tie-in at 60,000 volts with a capacity of 10,000 kw. Although insignificant in the amount of power to be transferred from one system to the other, the event is nevertheless one of great importance as representing the actual metal connection which binds together the electrical systems from Oregon to the Mexican border, an actual stretch of copper of more than 1,400 miles (2,250 km.), the distance between New York and Omaha.

The splendid success of the now considerable number of long transmission lines of 100 kv. or more has given rise to much speculation concerning further advances. The very valuable results achieved through interconnections of neighboring electric supply systems in meeting the heavy demands of the war emergency furnish the incentive for study to determine the possibilities of large benefits from more extensive interlinking of electric power sources over wider areas. It has been authoritatively stated that for one large California power company the sole means by which it was practicable to meet the urgent demand upon it was the interconnection with a neighbor company having surplus capacity.

The earnest and broad discussion at the recent convention of the Pacific Coast Section of the American

Institute of Electrical Engineers at Los Angeles of a paper proposing a 220-kv. "busbar" from the northern end of California to Los Angeles served to indicate the large advances already made toward extensive interconnection. It appears settled that there are no excessively serious technical obstacles to be overcome. The possibility of utilizing small power sources not otherwise capable of economical development and of obtaining the advantage of diversities of water-power supply, as well as load, emergency service and other like benefits, is suggested. Questions of ownership, control and operation loom large and will naturally require much study.

The beginnings of such extensive extra-high-voltage lines are already in existence. The 150-kv. Big Creek-Los Angeles line and the long 100-kv. systems supplying the Chicago, Milwaukee & St. Paul Railway electrifications in Montana, Idaho and Washington are perhaps the most notable examples. With the completion of such additional lines as those now contemplated in northern California the vision will come near to reality.

In view of such considerations the question of the future interrelations of existing and proposed extra-high-voltage circuits deserves the most careful study of engineers of electric power supply.

Incomplete construction cost data are a thorn in the flesh of the engineer trying to determine the reasonableness of subsequent estimates and later outlays. The practice of "lumping" various bulky equipment into single expense items may satisfy the banker, but it is only an annoyance to the engineer seeking definite and classified information.

Life of Poles

WHEN one thinks of the vast aggregate length of the pole lines standing in this country, supporting conductors for power, railroads, lighting, telegraph and telephone and of the number of forest trees that have to be cut down in order to provide them, it is evident that the steady perennial depreciation and decay of all these poles mean a heavy drain upon the forests of the country. Eventually, we may be forced economically to the general adoption of reinforced-concrete poles instead of wooden poles; but until that time comes we should do what may be commercially practicable toward diminishing the rot and depreciation of the pole lines in service on our highways. An instructive article on this subject is presented this week by Page Golsan. Mr. Golsan's article is not specifically directed to chemical impregnation of the poles but to a study of the rate of their depreciation by exposure to the weather and to a consideration of the causes of breakdown. It would appear that, at least in the region where these tests were made, the rate of decay does not depend materially on the nature of the soil. Moreover, the statistical data presented go to show that the percentage rate of decay with time is roughly according to a straight-line law, after the first three years have passed. In those first two or three years, the depreciation is relatively small. On the whole, the pole strength falls to one-half, on the average, in about eight years. After the poles have weakened unbalanced lateral stresses are much more dangerous than simple vertical stresses, toward bringing about their collapse. The conclusion is that wooden pole lines should be carefully guyed and braced, in order to remove and cancel all lateral stresses or forces tending to break the stubs at the ground line. This is, of course, no new doctrine, but the simple and clearly expressed mathematical reasoning emphasizing the doctrine is timely and serviceable.

The electric central-station industry as a whole has little reason to regret its work in financing, but it is well to realize before the day of reckoning comes that if the potentialities of customer ownership are good, the possibilities of serious injury to local good will are very great where dubious methods are employed to market securities.

Keeping Up the Illumination

IT IS a comparatively simple thing to lay out an installation for the proper illumination of almost any room. It is quite another thing to insure that the standards shall be kept up under the various circumstances of every-day use. Ward Harrison and J. R. Colville gave in last week's issue of the ELECTRICAL WORLD a striking study of the situation found in an office installation which had been neglected. The results are especially to the point because they involved all the elements of depreciation which one is likely to encounter. The system consisted of indirect units which had been in operation more than two years. The ceiling was flat white and the walls light buff, both originally having good reflecting power. The reflectors had been wiped out with fair regularity, but the lamps had been in service for two years, and the ceiling and walls had been gradually soiled by the smoke of the city, so that the reflectors had fallen far below their standard quality. The average illumination actually found on the desks was 2.7 foot-candles—decidedly too little.

The first step was to take down the reflectors and wash them thoroughly. The result was an increase of 35 per cent in the measured illumination, an illustration of the difference between perfunctory dusting and real cleaning which is much to the point; for where lighting units are exposed to soft-coal smoke, as they often are, a deposit forms which does not yield to anything but thorough cleaning. Next the lamps received attention, with the result that they were found to have been intended for a voltage higher than the average voltage of the circuit and to have depreciated considerably. The former difficulty may have arisen from sheer misinformation as to the real voltage at the outlets, or possibly from carelessness in purchasing the lamps. Whatever the reason, the result, complicated by too long usage, was rather disastrous. When replaced by new lamps at a proper voltage the illumination rose by nearly 1.5 foot-candles. Finally, the ceiling and walls of the office were refinished in the original tones, and the illumination then jumped up about 2 foot-candles. The net result was that an installation of entirely adequate design, giving more than 7 foot-candles when in proper condition, had dropped to 2.7 foot-candles through depreciation caused by neglect. Perhaps indirect lighting, because of its up-turned reflectors, with their interior condition concealed from the eye, and its dependence on the widespread diffusing surfaces of walls and ceilings exposed to smoke, suffers to an exceptionally great degree from negligence; but semi-indirect and direct systems are far from immune, and

examples could be found of either system little less bad than the one here cited.

From a practical standpoint, the efforts of the engineer should be directed toward allowing a factor of safety in the original design to take account of good ordinary conditions of use, and then to insistence that these good conditions be kept up. In a month of ordinary city service depreciation from dirt is likely to range from 20 to 40 per cent. The plain moral is that glassware or other reflectors should be thoroughly cleaned every two or three weeks if under ordinary city conditions, and if there is reliance on the ceiling and walls as reflecting surfaces, the condition of these surfaces must be carefully watched and they should be freshened whenever necessary. As this is a rather serious job, it is important to allow a larger factor of safety in the use of indirect and semi-indirect installations than in the case of plain reflectors. Aside from this, the lamps must be replenished, or there certainly will be trouble from lack of light.

All things considered, the authors recommend a factor of safety of from 1.2 for favorable conditions to 1.5 for very unfavorable ones. If an illumination is in first-class condition at the start, an occasional inspection with a foot-candle meter affords extremely valuable information as to what is going on; but in any case foresight is preferable to hindsight, and persistent cleaning is the obvious way out of the difficulty.

Customer ownership of public utility securities is a wise policy if sound values are maintained by upright and progressive management. Great care is essential, however, in marketing such securities, to avoid policies which threaten the reduction of dividends or loss of interest, or which throw discredit upon shares or bonds as collateral acceptable by conservative banking institutions.

Protection for Branch Circuits

A BRIEF paper by H. C. Horstmann and V. H. Tousley in the current issue gives some valuable suggestions regarding the protection of branch circuits in industrial plants. It is usual in such cases to run the main conductors near the ceiling, often on open cleat work, and to tap from these mains the conductors for individual motors or groups of lights. To carry out this construction according to the insurance rules, one must either drop down with conductors of the same capacity as the mains or install fuses at the tap. The first procedure is expensive, the second is extremely inconvenient, especially in the case of blowing a fuse, because fuses at the ceiling are not easy to reach and considerable delay is likely to intervene before they are properly replaced. The tendency therefore in such cases has been to fuse the wires pretty liberally, perhaps much too liberally as compared with ordinary rules and precedents.

The purpose of the writers of this discussion is to point out to what extent safe conditions can be met while still making the tap of moderate size and fusing it only within easy reach. In order to secure safety the tap wire must be able to stand heating up to the point where it will blow the fuse or open the circuit breaker back of it, and the total resistance of the tap line must therefore be low enough to allow the current and short circuit to rise to this point. The authors give details of the temporary current capacity of wires such as would be used for taps, by which sufficient protection against over-heating can be insured while still allowing time enough for the circuit to be opened further back. With proper installation of tap circuits in conduit a considerable economy could be effected by working in this way and the proposition is well worth consideration.

If managers of electric central stations keep a close watch upon their coal supply situation, the present tendency to get "jumpy" over irregularities of shipments and variations in quality will be considerably relieved. The time is ripe for a cool-headed study of fuel requirements over a long period, including the never-ceasing pursuit of economy in coal consumption.

An Industrial Lighting Survey

ONE OF the papers before the recent convention of the Illuminating Engineering Society, which we take pleasure in presenting this week, deals with a somewhat comprehensive investigation of the lighting conditions actually found at the present time in industrial plants. The survey covered representative cities in fifteen states, including in all 446 plants. The striking feature of the report is that, in spite of the obvious need for good lighting to maintain the best working conditions from the standpoint of output, 60 per cent of the total number required some measure of improvement, not infrequently large. On the whole the big plants were better lighted than the little ones, and their managers took a more intelligent interest in the matter. Apparently the chief difficulty has been lack of interest in lighting from failure to appreciate what it means in production. Only about 60 per cent of the responsible men interviewed during the inquiry knew anything about the modern gas-filled lamp, to say nothing of having a realization of its possibilities.

Just why the average manufacturer should be so relatively indifferent is hard to say, although probably the growing importance of artificial lighting has not yet forced itself on the attention of managers who think of their plants in terms of daylight rather than darkness. An interesting revelation of the same attitude of mind was, that of the men interviewed about half said that they would go to the electrical retailer or jobber if they wanted to do anything in the matter, and only about one man in five was disposed to turn to the architect, the engineer or central station for help. The meaning of this situation is threefold. First, the average manager would go to the contractor if to anyone and consequently would not seek his aid until he had fairly definitely made up his mind that changes were necessary, and that he was ready to consider buying equipment. This puts the burden of improvement, so to speak, on the introspection of the busy manufacturer. Second, it is equally clear that the electrical dealer has a large and comparatively unworked field before him. There are not a few dealers who have rather keen interest and plenty of knowledge regarding illuminating matters, and they evidently can do a large amount of good in industrial lighting. Third, by this same token it is very clear that electrical dealers ought to specialize in illuminating matters more than they generally do. There is certainly need of very much missionary work, especially for the accumulation of convincing data as to the improvement of operating conditions due to good illumination.

The Economy of Static Condensers

Most Advantageous in Sizes of 500 Kva. or Less, Making Them Particularly Suitable for Power-Factor Correction in Industrial Plants—Experiences of Two Electric Service Companies

By FRANK HERSHEY
General Electric Company

THROUGHOUT the last year static condensers assisted to a marked degree in improving the power factor on the lines of electric service companies. Inasmuch as the adavntages of the static condenser compared with the synchronous motor or condenser are more pronounced for capacities of 500 kva. and below, the demand for this type of apparatus, as was expected, was greatest among industrial consumers who purchased equipments in accordance with recommendations from the central stations supplying them with power. At the same time, a number of equipments were ordered by utility companies for installation at substations and at outlying points on some of their feeders supplying power to a large number of small consumers. It was because the individual requirement of each customer was comparatively small that it was more economical to consider group rather than individual correction.

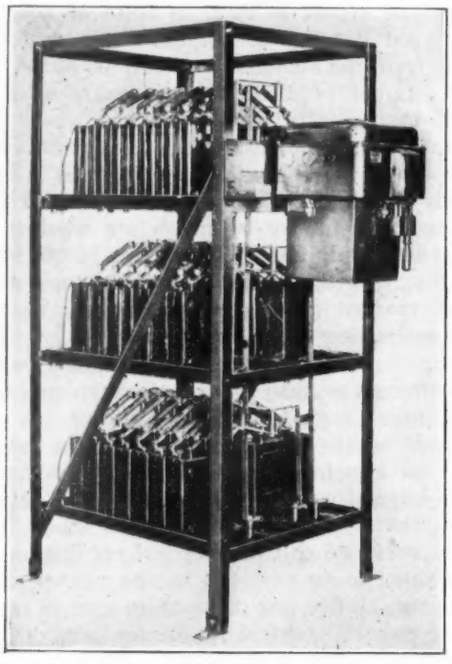

FIG. 1—THREE-PHASE, 60-CYCLE, 2,300-VOLT STATIC CONDENSER WITHOUT REACTOR AND DISCHARGE RESISTANCE

Static condenser equipments for 2,300-volt service consist of a number of condenser units, a reactor for dampening out the higher harmonics in the voltage wave which would affect the corrective capacity of the units, a discharge resistor for draining the condenser charge when disconnected from the line, and an oil circuit breaker for the control of the equipment. For 220, 440 and 550-volt service an auto transformer is also provided designed to step up the supply voltage to 1,200 for the condensers in order to provide for more economical use of the active material. The number of condenser units included in an equipment is directly proportional to the capacity required, each unit having a capacity at 60 cycles of 5 kva.

Condensers of the type under consideration have been standardized for installation on circuits ranging in frequency from 40 to 125 cycles, in voltage from 220 to 2,300, and in capacities from 30 kva. to 300 kva., the smaller sizes being 30 kva. and 60 kva., and then increasing in steps of 60 kva. to 300 kva. For the correction of power factor on circuits exceeding 2,300 volts transforming apparatus consisting of either a transformer or an auto-transformer is furnished, the choice depending on the ratio of transformation required to step the voltage down to 2,300 volts, and a suitable oil circuit breaker is provided to control the equipment from the line side of the transforming apparatus.

RELATIVE ADVANTAGES AND DISADVANTAGES

The advantages of the static condenser as compared with other forms of apparatus for power factor correction are as follows:

The cost is comparatively low in small sizes.
No special location or foundations are required.
The losses are extremely low.
Practically no attendance is required.
There are no moving parts to wear out.
The condenser is noiseless in operation.

The disadvantages are:

The capacity is less easily adjusted than that of the synchronous condenser.
No lagging correction is obtainable.
The cost is high in large sizes as compared with the synchronous condenser.

A comparison of the costs per kva. between static and synchronous condensers is given in Fig. 3. It will be noted that the static condenser costs less than synchronous apparatus below the ratings tabulated.

Volts	Kva.	Volts	Kva.
220	130	550	210
440	175	2,300	475

More important than first costs, however, are the annual costs of operation. Assuming that the full corrective capacity is required for a period of ten hours per day, or 3,500 hours per year, a charge for energy at ½ cent per kilowatt-hour and capital charges of 15 and 20 per cent respectively, without attempting to include an installation and maintenance charge, a comparison of annual operating costs, shown in Fig. 2, will indicate that marked economies can be obtained by using static condensers of much higher capacities than the limits determined on the basis of first cost.

That static condensers have affected economies in plant operation is evidenced in the following report from W. A. Forbush, superintendent of the Edison Electric Illuminating Company of Brockton, Mass., summarizing the results obtained by the installation of two 200-kva., 2,300-volt condenser equipments at the Stoughton substation*:

The loads varied from 700 kw. to 780 kw. Without the condenser the average power factor was 70 per cent, giving 1,057 kva. with a voltage of 12,400. The connection of the condenser raised the power factor to 90 per cent, giving 822 kva. with a voltage of 12,850. That is, the kva.-load was reduced over 20 per cent and the delivered voltage improved nearly 4 per cent. These results check very

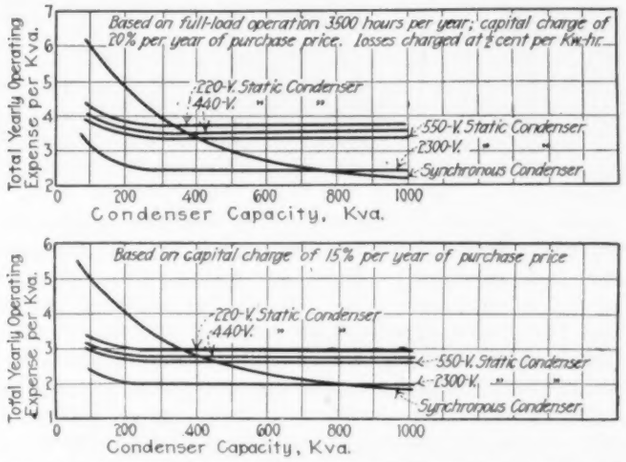
Based on full-load operation 3500 hours per year; capital charge of 20% per year of purchase price. Losses charged at 1 cent per Kw-hr.
220-V. Static Condenser
440-V. " "
550-V. Static Condenser
2300-V. " "
Synchronous Condenser
Total Yearly Operating Expense per Kva.
Condenser Capacity, Kva.
Based on capital charge of 15% per year of purchase price
220-V. Static Condenser
440-V. " "
550-V. Static Condenser
2300-V. " "
Synchronous Condenser
Total Yearly Operating Expense per Kva.
Condenser Capacity, Kva.

FIG. 2—TOTAL YEARLY OPERATING EXPENSES PER KVA. FOR STATIC AND SYNCHRONOUS CONDENSERS

closely with the original calculations, and continued service has verified them.

Approximate calculations were made to see what the annual savings would be. The average day load was assumed to be 607 kw. for a twelve-hour period. For the other twelve of the twenty-four hours the load was taken as 390 kw. This, for a twenty-five-day month, that being an average number of working days, gave an annual reduction of transmission losses of 205,000 kw.-hr. This represents a substantial saving.

While the above results were valuable and would of themselves have justified the installation, the primary object here was increased capacity. This was accomplished, as previously shown, to the extent of about 20 per cent and permitted the Stoughton district to care for its growth over a critical period.

The financial aspect may be shown roughly as follows:

Cost of 400 kva. capacity	$7,500.00	
Expense of transportation and installation	300.00	
Cost of set installed		$7,500.00
Annual fixed cost, 15 per cent		1,125.00
Increased capacity made available in Stoughton, 300 kw. Value of capacity, 300 kw. at $50 per kw. ($50 per kw. taken as the cost of transmission and conversion investment)		15,000.00
Annual fixed cost, 15 per cent		2,250.00
Reduction in losses, 225,000 kw.-hr. 225,000 kw.-hr. at $0.0075 per kw.-hr.		1,687.50
Annual saving		$3,937.50
Annual cost		1,125.00
Net annual saving		$2,812.50

We believe that these figures show the value of the installation to us. They might be made even more impressive by taking the savings on the greater load which will soon be carried, but every attempt has been made to be conservative.

*Excerpt March issue *Stone & Webster Journal.*

We can say without qualification that we are most satisfied with the results as they have shown themselves. This is true with regard to improved voltage regulation, better power factor, decreased losses and increased capacity.

Static condensers have also been used effectively to relieve an overloaded distributing system and have made it unnecessary to install additional transformer capacity. An example of this was given in the Feb. 2, 1918, issue of the ELECTRICAL WORLD, by J. F. Dubois, manager electrical department, Lynn Gas & Electric Company, Lynn, Mass. The results obtained are summarized as follows:

Early in 1915, two static condensers rated at 100 kva. each were installed and connected to the secondary network. Space not being available at the factory first mentioned, one unit of 100 kva. was located in a machine shop across the street. At another point a portable galvanized-iron building was erected to house the other condenser. The company found itself able to take on this factory of 160 hp. in motors without the addition of a single transformer or

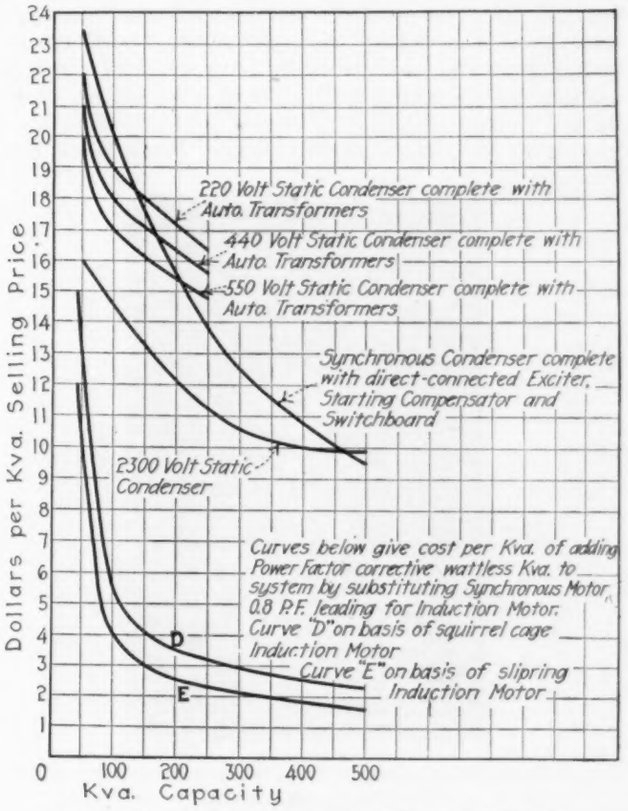
220 Volt Static Condenser complete with Auto. Transformers
440 Volt Static Condenser complete with Auto. Transformers
550 Volt Static Condenser complete with Auto. Transformers
Synchronous Condenser complete with direct-connected Exciter, Starting Compensator and Switchboard
2300 Volt Static Condenser
Curves below give cost per Kva. of adding Power Factor corrective wattless Kva. to system by substituting Synchronous Motor 0.8 P.F. leading for Induction Motor.
Curve "D" on basis of squirrel cage Induction Motor
Curve "E" on basis of slipring Induction Motor
D
E
Dollars per Kva. Selling Price
Kva. Capacity

FIG. 3—COMPARISONS OF FIRST COSTS OF STATIC AND SYNCHRONOUS CONDENSERS

the changing of the circuit in any way except in the installation of the condensers. The power factor of the circuit at the station was raised to about 78 per cent. The results were so satisfactory that in the present year another unit, of the subway type, was installed in an ordinary transformer manhole on Monroe Street, Lynn. This equipment is working perfectly at present, and in a recent test it raised the power factor of the circuit at the station from 60 per cent with the condensers all off to 90 per cent with all the units in, the present load being about 440 kva.

INDUSTRY *must be humanized, not destroyed. It must be the instrument not of selfishness but of service. Change not the law but the attitude of mind. Let our citizens look not to the false prophets but to the Pilgrims.*—CALVIN COOLIDGE, *Governor of Massachusetts.*

Researches in High-Voltage Insulation

Extensive Tests of Suspension Insulators Show that Temperature Changes Are the Most Serious Causes of Failure — Promising New Types of Insulators Are Undergoing Test of Actual Service — Extra High-Voltage Lines Seem Assured

By HARRIS J. RYAN
Professor of Electrical Engineering, Leland Stanford Jr. University

THE existing conditions in recent years have served to emphasize the importance of vast extensions of the high-voltage power networks for the reclamation water powers, the conservation of fuel and to enhance the economic use of existing power plants. Power engineers have, therefore, been engrossed in comprehensive studies of all essentials that relate to a nation-wide extension of electric power service. In these studies power transmission engineers who know the status of high-voltage transformers, switch gear and line insulators have acquired the conviction that a decided increase in line voltage may now be undertaken with safety in new projects when warranted by economic considerations. Projects of this

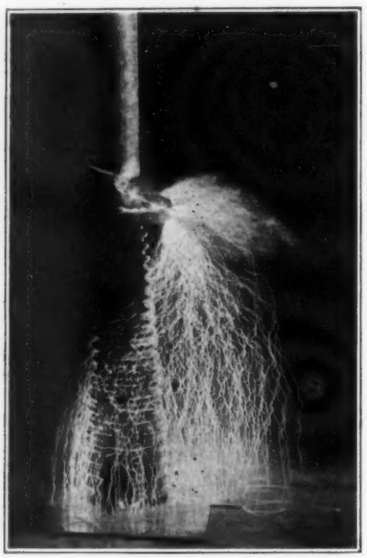

FIG. 1—DISCHARGE OVER POST INSULATOR AT RADIO FREQUENCY

sort are new power developments, as such, wherein 75,000 kw. or more per circuit must be transmitted over distances ranging from 200 miles (320 km.) upward and 220,000-volt buses for the economic exchange of power over state-wide or even greater areas. The advent of this conviction had been delayed in part by the lack of durability of the general run of high-voltage line insulators. It is natural, therefore, that a return should have been made to the difficult study of all factors that relate to insulator durability and of means for the improvement of the duty service to be had from the insulators available in the present state of the art.

Insulator manufacturers have displayed enterprise in the improvement of factory ceramics, insulator assembly and factory tests, in making improvements in old designs, in courageously producing new designs and in trying them out in practice.

Many insulator durability studies were interrupted by the war and were renewed during the year now closing. In one instance cap and pin suspension insulators of various makes undergoing natural daily temperature cycles by yard treatment in 1917 were left for the duration of the war as follows: one-half in the yard to continue the daily and seasonal temperature cyclic treatment and the other half in even temperature storage for control. After 750 days all were returned to the laboratory and tested for failure by 1000-volt direct-current megger, the "buzz stick," "spark stick," under flash-over voltage and ten seconds spark-over voltage. These insulators were of the 1911-14 vintages that lack durability. Those left in the yard continued to fail at an accelerating rate as was expected, while but few failed among those left for control in even temperature storage. Beyond all doubt, therefore, inability to withstand temperature changes is almost the total cause of deterioration in this type of insulator after it has passed the factory and acceptance tests.

A batch of eighteen cap and pin "high-temperature" glass suspension insulators had also been subjected to natural daily temperature cycles for a year in the yard prior to the war period. One only had failed. They too were continued in the yard for 750 days through and beyond the war period and were then retested. Nine out of the seventeen were found to have failed—a far higher rate than that occurring for the poorest cap and pin porcelain insulators. The higher rate of failure of these glass suspension units must be attributed to their physical properties compared with those of porcelain. Glass is amorphous, vitreous and brittle, while good porcelain is cellular, non-porous and tough.

Having come to a clear understanding that the chief cause of the excessive deterioration of cap and pin porcelain insulators has been their inability to withstand indefinitely natural temperature changes, many transmission engineers have renewed their faith in their ultimate dependability. To this manufacturers have reacted by making improvements in construction and in factory technique for minimizing effects due to temperature that promise greater durability henceforth.

NEW TYPES OF INSULATORS UNDER TEST

Long high-voltage circuits were equipped with a comparatively new type of suspension insulator. Therein the cap of the porcelain disk is replaced with a stout porcelain core. The metal linking-up pieces have tines that are anchored in the end faces of the porcelain core with a special alloy cast in. No cement is used. A radical departure in the structure of the suspension insulator has thus been introduced. In the aggregate the circuits carried by these core and tine insulators are being subjected to wide variations in climate. They will have to endure the extremes of temperature and other elements encountered at high altitudes in the southern Sierras, in the lower hot and dry areas of the far South-

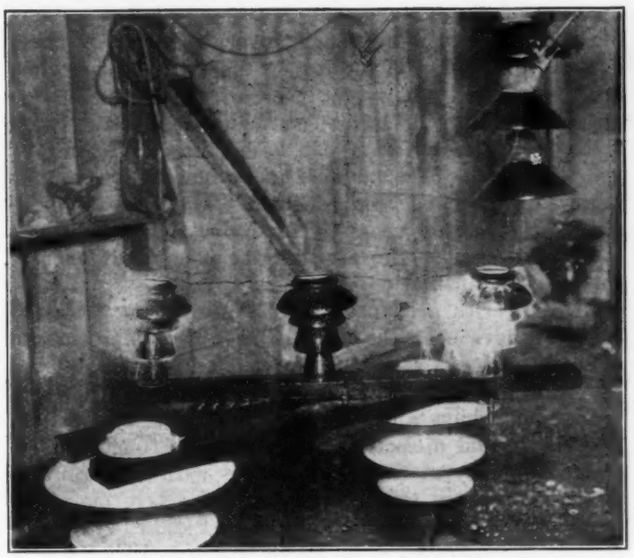

FIG. 2—RAIN TEST FOR PIN INSULATORS

west and the more humid areas of the far Southeast. There is, therefore, in progress a great practical durability test that can be reproduced and foreshortened in no laboratory as yet. The durability returns from these core and tine insulators will be received and studied with care during the ensuing five years.

Interest is being revived in the pioneer type of suspension insulator wherein the porcelain disk has a bomb-shaped center pierced to receive links which constitute the connecting-up hardware. This may be designated as the bomb and link type. Many transmission engineers are renewing their studies of the advantages and disadvantages of this type of suspension insulator. The manufacturers thereof have undertaken to extend their facilities for its production. Its present-day electrical, mechanical and durability factors are being studied through records and in the field and outstanding laboratories. To some it seems highly probable that a general return to the use of this type of insulator will result in a material advance in suspension insulator durability.

The technical paper treating the probability factor

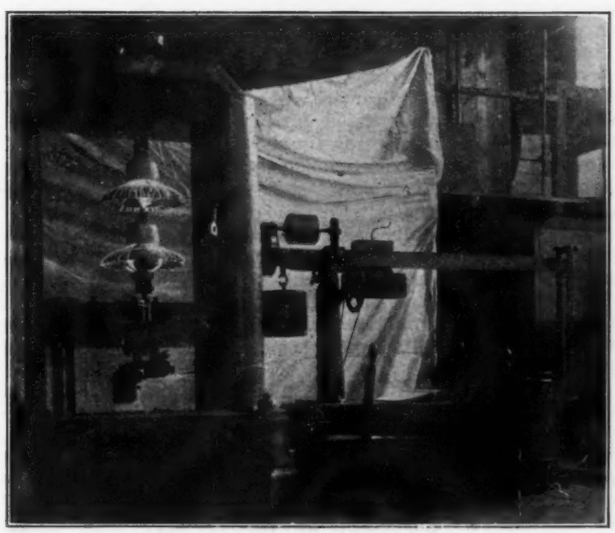

FIG. 3—COMBINED RAIN AND TENSION TESTS OF SUSPENSION UNITS

in the make-up, use and maintenance of strings of suspension insulators that was read at the Los Angeles convention of the American Institute of Electrical Engineers is of lasting importance. It deals with some of the outstanding factors that must always be understood and relied upon for the successful use of this form of insulator.

Pin-type insulators for the support of 22, 33, 44 and 66 kv. circuits have been given further study in the factory and field with the result that some real advances have been made. Substantial designs have been reformed so as to raise materially the ratio of wet to dry flash-over voltages. So far as is known such result can only be obtained by the avoidance of overstresses of the

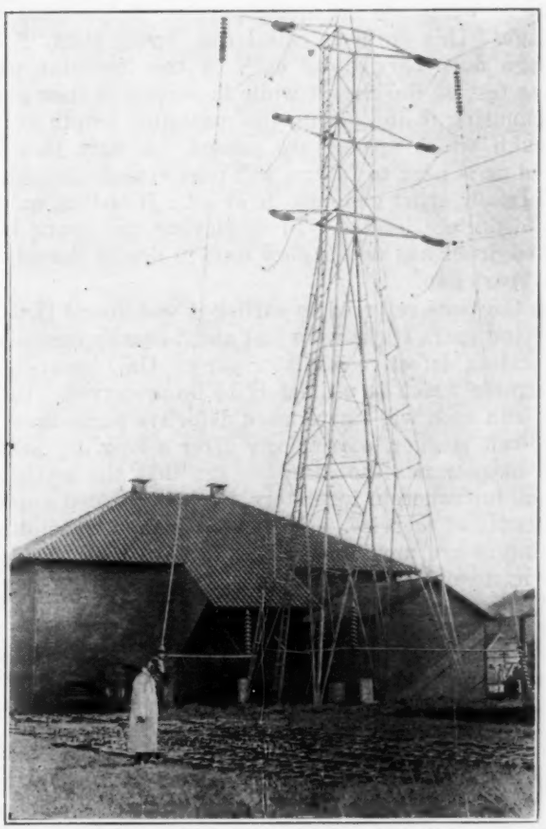

FIG. 4—SUBJECTING SUSPENSION INSULATORS TO DAILY TEMPERATURE CYCLES AT STANFORD HIGH-VOLTAGE LABORATORY

air adjacent to the insulator surfaces at substantially all voltages below flash-over.

Transmission engineers in the field have continued with success their efforts to discover and to use means for locating on live circuits porcelain parts in suspension and pin-type insulators that have failed. The best results have been obtained by the use of suitable means for gaging the voltage duty carried by each individual porcelain part of the insulator.

One such method consists in the use of a U-shaped metal discharger mounted on the end of an insulating rod of convenient length. The implement is called the "buzz stick" by its engineer advocate. The discharger is placed in the stray electric field about the insulator formed by the line voltage. The observer notes the character and location of the noises that occur because of the overstresses thus produced in the atmosphere. By experience he learns to judge of the presence of one or

more defective parts in the insulator. Unless there are too many defective parts present, rendering the procedure unsafe, such parts are then identified by shorting all of the parts, one at a time, with the discharger. Those defective will deliver weak spark discharges or none at all.

In another method the insulator part is shunted with suitable tine-like electrodes through an adjustable spark gap in series with a condenser having a capacitance of about one-quarter that of each of the insulator parts. These things are made light and are carried on the end of a conveniently proportioned insulating rod. The spark gap is inclosed and sound therefrom is carried to the ear of the test man by a listening tube. The insulation strength of the condenser is made sufficient to withstand an ample portion of the total line voltage. This outfit is called the "spark stick." The voltage duty carried by each of the insulator parts under test on the circuit while in service is then gaged by shunting it and noting the maximum length of gap through which sparks are passed. A part that has failed or is near to failure will pass sparks through an abnormally short gap only, if at all. It is thus quickly and definitely located. In employing the spark stick one engineer has used a glow bulb in lieu of the adjustable spark gap.

In the tests referred to earlier it was found that the buzz and spark sticks were just about equally dependable in locating defective insulator parts. Only practice can determine which is ultimately to be preferred. In the long run each will locate more defective parts than the 1000-volt megger, particularly after a long dry season. The megger has the disadvantage that the section of the circuit wherein insulators are being tested must be put out of service. However, many transmission engineers are unwilling as yet to have their insulator test men work on live circuits. The use of the megger will, therefore, likely be continued to a considerable extent during the immediate years to come.

INSULATION STUDY AT 500,000 VOLTS AND 60,000 CYCLES

Modern high-powered radio-telegraph stations radiate hundreds of kilowatts from antennae at 100,000 volts or more. Because of the high frequencies employed, huge, wasteful and destructive coronas are formed from any conducting electrodes when atmosphere adjacent thereto is permitted to be overstressed and ionized to the slightest extent. The higher voltage duties which the suspension insulator units placed next to the line conductor must sustain because of electric flux leakage present a difficulty in the use of this form of insulator for the radio engineer, just as they do for the power engineer when the voltage to ground approaches 100,000. To study these difficulties and to find their remedy a 500,000-volt, 60,000-cycle laboratory source was provided by one manufacturer. With it many important studies of a variety of remedial expedients, such as metal guards, graded parts and electrodes that are continuously and tightly covered with porcelain, have been tried. It is to be hoped that the results obtained thereby will be published soon for the benefit of all.

Progress was made in knowledge of the fundamentals requisite for the successful insulation of underground cables and armature conductors for moderately high voltages. Such insulations must be continuous sheaths built up of dielectric sheets, fibers and binders. They have attained ranking importance. In most of these sheaths air is present in films or filaments. Such films are weaker dielectrics than the sheath-forming materials. Heretofore little has been known of the dielectric strength characteristics of these films. Within the year the results of a valuable and extensive research in regard hereto have been reported. They have demonstrated the positive necessity for reducing to the utmost the thicknesses of the air films that tend to form in this class of insulation.

In dielectrics perhaps the most interesting items of the year have been the limited reports of piezoelectric motor phenomena. These were studied by many during the war and some remarkable results were obtained. They should have a considerable peacetime application. Certain crystal dielectrics were made to function electromechanically at radio frequencies with high efficiencies and at more watts per pound of active materials than occurs correspondingly in the best known synchronous motors operated at 60 cycles under full load. It is to be hoped that when peace is finally and fully established, complete reports of the work done in piezoelectrics may be published.

Public Utilities of Indiana Organize

Indiana public service companies have organized the Indiana Public Utility Association, the purposes of which are to consider common problems of the members and to enlist public co-operation in a movement to improve standards of service, despite the high cost of living. The officers of the new organization are: President, Charles L. Henry, Indianapolis & Cincinnati Traction Company; vice-president, Harry Reid, president Interstate Public Service Company; treasurer, Charles C. Perry, Indianapolis Light & Power Company; secretary, Thomas Donohue, manager Lafayette Electric, Gas & Heating Company and secretary of the Indiana Electric Light Association. The membership includes gas, traction, light, heat and power, water and telephone service.

The organization issued the following statement outlining its purposes subsequent to its organization:

Public service companies throughout the United States are facing a critical situation because of the continually advancing costs of material and labor. The situation in Indiana, where it is almost impossible to advance rates in step with increasing costs, is typical of the national situation. Rates for public service are more or less static. They are fixed and they stay fixed until such time as, after much legal procedure and necessarily slow financial investigation, they can be shown to be insufficient. Service is frequently impaired, and the companies suffer losses while the public suffers inconvenience until rates can be readjusted.

The public is usually in no mood to put up with poor service or with facilities outgrown since war days, and because all other service and commodities have been and are increasing in price, the public is resentful of new increases. On the other hand, public service companies provide common service and rightfully expect some measure of co-operation from the public.

They must, therefore, find sufficient income to meet increasing labor and material costs to maintain and improve pre-war standards of service. At this period their problem is especially difficult because maintenance and replacement materials, as well as operating materials, such as coal for example, have increased in price. In nearly every phase of utility service, replacement and maintenance work lapsed during the war, with the result that the companies are now taking it up again under a severe handicap.

Natural Life of Cedar Poles

Quantitative Study of Butt Rot Shows that Cedar Poles Should Last from Fourteen to Seventeen Years—Mechanical Strength Is Determined Largely by Side Pull and Poles Should Therefore Be Well Guyed

By PAGE GOLSAN
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FOR the appraisal made by the Southern California Edison Company several years ago it proved to be necessary in the determination of depreciation annuities to assign an average useful life to round cedar poles. While inadequacy for service, action of public authority and other factors cause the early removal or replacement of many poles, the largest number are not replaced until the time when rot brings about the end of their natural life. Results can, therefore, be reached more intelligently if the average natural life of an undisturbed pole be known and such life be tempered with the probabilities of functional depreciation as determined by local experience. In carrying out this investigation the average rate of rotting at the pole but was determined and the life calculated from the change in diameter at the butt. Since the greatest danger is that poles may fail near the butt due to sidewise pull, they should be guyed when subjected to such stress. It is also economical to use poles of large butt diameter because the pole strength varies as the cube of this diameter.

In connection with this appraisal, two crews were sent into the field at Los Angeles, and 1021 poles of varying ages up to ten years were examined. The soil was dug away for a depth of 12 in. to 18 in. (30 cm. to 45 cm.) and the rot chopped off with hatchet and pick. The original unrotted diameter and the diameter of firm wood at the rotted section were averaged from five or six measurements in each case, and the character of soil was noted.

Almost invariably it was found that the rot was confined to a small cylindrical portion near the ground surface only. While it has been held that such rot is caused by microscopic organisms, the author is of the opinion that it is largely caused by an intermittent wetting and drying of the pole, the outflow of water gradually carrying the soluble matter away until only the unsupported cellulose fibers remained. Except for knots and certain favorable settings, the depth of penetration of rot was usually found to be uniform around the circumference of the pole.

An investigation of the records before starting field work showed that a large number of the poles had been treated by brush application with a coating of a thin carbolineum paint. To divide the results between poles so treated and poles not treated, an attempt was made to note this fact during the field observation. With the exception of settings under two or three years, however, practically no traces of the treatment could be found. Evidently cold brush treatment does not give deep enough penetration for thorough waterproofing, and the paint was soon washed out. Whether the chemicals reduced the attack of insects in the early years cannot be said. The results of this field investigation are shown in Fig. 1, treated and non-treated poles being averaged together.

It will be seen that the type of soil had not a very definite effect on the rate of rot, and to smooth out the results an average of these curves was compiled and

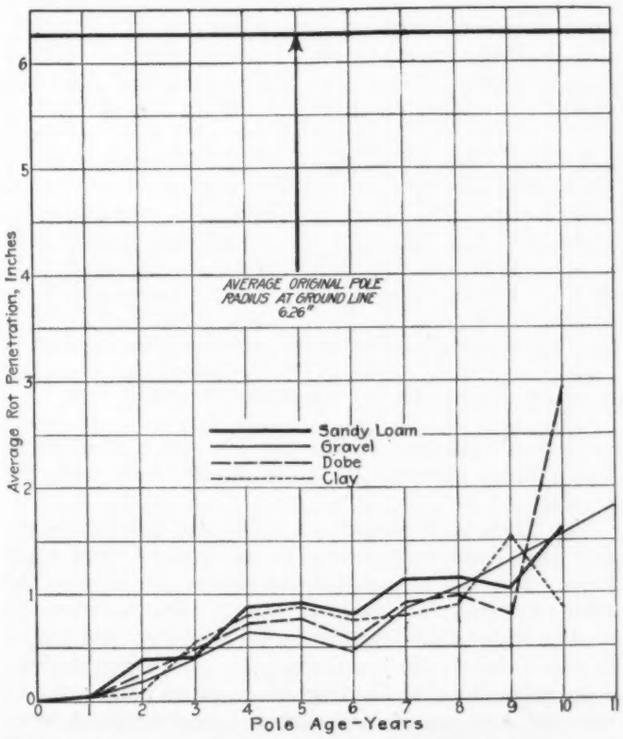


FIG. 1—EFFECT OF POLE AGE ON ROT PENETRATION; DATA FROM WHICH SAFE LOAD OF POLES MAY BE DETERMINED

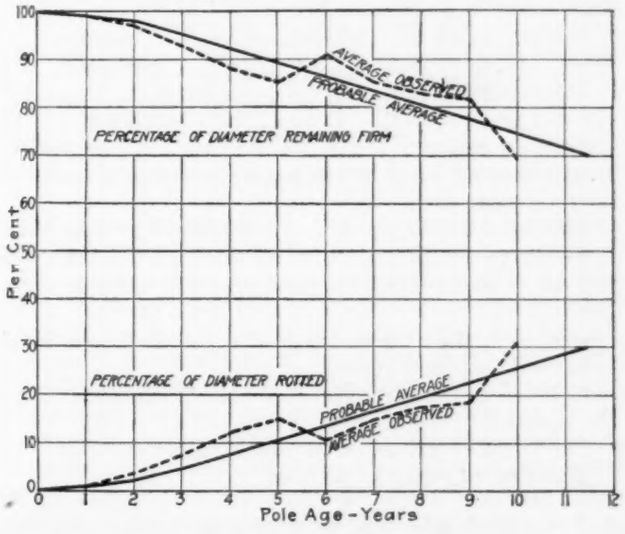


FIG. 2—PERCENTAGE OF POLE DIAMETER REMAINING FIRM AFTER DIFFERENT PERIODS OF SERVICE

transferred to Fig. 2 as the percentage of the average pole diameter rotted away at each year of its age. This curve was then further smoothed out by drawing a probable average rate of rot. Deducting these curves from 100 percent produces the "percentage of diameter remaining firm" for each year as shown.

Obviously the replacement of a pole from natural causes is a matter of safety. It cannot be left to stand until it falls over, and safety is a matter of its structural strength. A study of natural-pole life must take the structural strength into account.

FIG. 3
ERECTED POLE

Fig. 3 shows diagramatically a pole projecting out of the ground a distance l, with forces W and X, acting upon it. If it may be assumed that the ground is rigid, the greatest stress caused by W is practically at the ground line. Force X, consisting of the weight of wires, cross-arms, transformers, etc., is also at a maximum slightly below the ground line when the weight of the pole is added. We may assume the maximum stresses due to these forces to be at the ground line.

If D = the pole diameter at the ground, then the moment of inertia of this section is: $I = \pi D^4/64$.

Let f = maximum unit stress in extreme fibers of the firm wood surface at this section,

Then $f = MD/2I$ (where D = pole diameter and M = moment acting on the section).

The moment at the section due to W is: $M_w = Wl$; whence f_w (maximum unit stress due to W) =

$$\frac{M_w D}{2I} = \frac{WDl}{2\,\pi D^4/64} = \frac{32\ Wl}{\pi D^3}. \qquad (1)$$

At a point a this stress is tension or negative, at b compression or positive.

The area of the section at the ground line is

$$A = \pi D^2/4$$

Let $Y = X$ plus the weight of pole above ground. Then f_y (maximum unit stress due to Y) =

$$\frac{Y}{A} = \frac{Y}{\pi D^2/4} = \frac{4\ Y}{\pi D^2}. \qquad (2)$$

This stress is positive at both a and b.

The maximum unit tensional stress is, therefore: (2) — (1), or $f_t = f_y - f_w = 4Y/\pi D^2 - 32Wl/\pi D^3$. (3)

The maximum unit compressional stress is, therefore, (2) + (1), or $f_c = f_y + f_w = 4Y/\pi D^2 + 32Wl/\pi D^3$. (4)

Since in ordinary cedar the ultimate limit of resistance is about $f_t = 10{,}000$ lb. per square inch, $f_c = 6{,}000$ lb. per square inch.

And since in our equations f_c is always greater than f_t owing to the plus sign of equation (4), a pole will fail on its compression side and we are limited to equation (4).

If $Y = 0$, then the strength of a pole is proportional to the *cube* of its diameter.

If $W = 0$, the strength of a pole is proportional to the *square* of its diameter.

The question arises as to which factor controls.

Equation (4) may be written:

$$f_c = \frac{4}{\pi D^2}\,(8l\ W/D + Y). \qquad (5)$$

For a given pole this shows that each pound pull of W is $8\ l/D$ times more important than a pound pull at Y.

For a 40-ft. (12-m.) pole, 12-in. (25-cm.) butt, with 35 ft. (10.5 m.) out of the ground $8l/D = 280$.

If the pole, cross-arms, wire transformers and all weigh a total of 5000 lb. (2268 kg.), the effect of this weight is equal to an unbalanced pull at W of only $5000/280 = 18$ lb. (8 kg.), which may be exceeded many times over. This will bring home to the utility engineer the importance of strong and frequent guying.

The great effect of D^3 may be further clearly shown in determining the amounts of W or Y required to break a pole. Assume a pole of 15-in. (37.5-cm.) butt with 40-ft. (12 m.) out of ground. To break under W :

$$6000 = \frac{4}{\pi\ (15)^2}\left(\frac{8 \times 40 \times 12}{15}\ W + O\right)$$

$$W = 4140 \text{ lb.}$$

To break under Y :

$$6000 = \frac{4}{\pi\ (15)^2}\ (O + Y)$$

$$Y = 1{,}060{,}000 \text{ lb.}$$

Of course, the pole would buckle under column action long before force Y could be fully applied, but it merely shows that practically we may state that:

$$\text{Pole strength} = KD^3.$$

This being the case, we may replot the "remaining firm diameter" of Fig. 2, cubing the percentage of remaining diameter in each instance. The result is shown in Fig. 4.

This curve shows the rapid decrease in the strength of a pole as rot at the ground line proceeds and affords a tangible basis on which to judge natural life as based on factor of safety. A pole should certainly come out when its breaking resistance to a horizontal pull or to a non-centered dead-weight load has decreased to but 15 to 25 per cent of its original strength. Such a life, as determined by these observations, is found to be between fourteen and seventeen years. Of course, a large

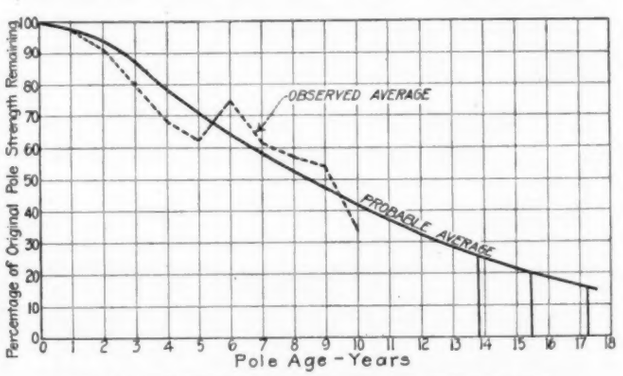


FIG. 4—CHANGE IN POLE STRENGTH DURING LIFE

number of poles may exceed this life, also a great many may rot out sooner. We have merely dealt with the average.

The formula, Strength = KD^3, also brings ou the fact that large butts are more economical than small butts. The cost of a pole by no means increases as the cube of the butt diameter, and it can therefore be readily shown that large butts, because they last longer in proportion to the investment, decrease renewal costs.

As pointed out at the beginning, many poles must be removed because of load changes, underground work and other functional elements before their natural life has been reached.

The Real Functions of the Engineer

Common Understanding of Social and Industrial Conditions Necessary so that the Human Factor Shall Not Be Overlooked in Engineering Design

By GEORGE W. BACON
Of the Firm of Ford, Bacon & Davis, Engineers, New York

ENGINEERING may well be regarded as the most aggressive of the professions; it thrives on change, on the new application of an old principle, the adaptation to the job of to-day of a new union of materials and mechanisms. In its broader aspects it must equate and relate the thing to be done to the social relations and conditions it aims to benefit. In other words, the engineer has a social as well as a technical function.

The bridge should be designed and located not only with due regard to the origin, direction and degree of the immediate traffic and the physical characteristics of the site, but with even greater consideration to the part it can be made to play in the development of the areas thus joined through inviting service.

The street or subway car with narrow exits or entrances or misplaced seats not only fails to serve the public effectively, but in like degree to return to the investor his just due. The expense of running the misfit is just as much as that of the car engineered to meet the traffic conditions, and the difference in the earning power of the two represents the difference, with adequate fare rates, between success and failure.

The plant designed without adequate provision for growth is no less fortunate than the one that disregards in its construction attractive and hygienic living conditions for its employees. Engineering has failed too much to insist on the significance of these facts.

The steamship whose dead weight is not properly related to the business of the route can prove a less desirable investment than one that is underpowered, poorly cuisined or improperly ventilated, if not a less desirable form of service.

Engineering gave eyes to the army and ears to the navy, and it stopped, as it enabled the start of, the Great War.

In helping to guide the correct solutions of the problems of peace, the technical as well as the broad economic talents of the engineer will be required.

Never has the engineer faced such opportunities for conserving resources or creating economies as are now presented to those who are equipped with that experience and that fearless regard for facts out of which grows sound vision—the man who does things and the men who back him.

Twenty-five years or more have passed since most of the engineers who are now deciding issues left the curriculum which has, to a greater or less degree, since become their background. At that day, and since, too little regard was had for the commercial and human factors with which engineering must function. Insistence on technique too frequently obscured tolerance for simple business principles.

To-day few businesses would incur the risk of eventual capital impairment through failing to reckon in the design and conduct of its plant and organization with the changing social conditions.

My point is that to-day, more than ever before, the engineer, be he old or young, who looks above and beyond mere technique and is able to visualize in terms of productivity to society the plant machine mechanism or application of principle upon which he is engaged, to work with and to really lead men in the mass, is the kind of engineer that will put on the map work that is worth while by applying sound practices to present-day needs.

On these broader phases of the problems of the engineer the attention of technical men is focusing more and more. Our political and economic organization rests on the use of mechanical devices in industry; that is to say, the production and distribution of finished products is fundamentally an engineering problem.

At the same time, so far as the main purpose of industry is the satisfaction of human wants, the control and management of mechanical processes involved in the production of finished products is in addition a social problem.

To an increasing degree must the schools of the country realize the importance of the social function of the engineer. In New York, for instance, the New School for Social Research, a school of graduate standards for business and professional men and women, has recently invited Guido H. Marx, professor of mechanical engineering at Stanford University, to offer a series of lectures and conferences designed to initiate discussion among technical men, with the object of developing some common understanding of industrial and social conditions. The idea is worthy of emulation in other important educational centers.

The social function of the engineer might be summed up as such disposition of the technological factors in industry as to eliminate waste from which the community now suffers, to increase production and to provide for more adequate distribution. Upon such broadly trained engineers is the direction of the country's industry today coming largely to depend.

The Effect of Lighting on Accidents

A chart published by the California Industrial Accident Commission gives the record of the number of accidents which occur in different months of the year. It is apparent that the ratio is inversely proportional to the length of the daylight period, the highest number of accidents being somewhat beyond the middle of December. The new industrial lighting law which has recently gone into effect in that State is expected to reduce the number of winter accidents at the same time that it increases the output of factories which have hitherto been inadequately lighted. This definite relationship between light and safety is the strongest argument for the rewiring of industrial establishments.

Central-Station Operating Ratio Decreasing

In Spite of the Increasing Costs of Labor and Materials, Manufacturing and Distribution Costs per Kilowatt-Hour Are Now on the Decline

THE review of the central-station industry for the past few years gives some very significant comparisons. In connection with its monthly survey of central-station output and revenue the ELECTRICAL WORLD has undertaken an investigation of the relation of operating expenses to revenue of central stations, in order that an accurate idea may be obtained of the distribution of the gross income of central stations between manufacturing and distribution expenses and income available for interest and

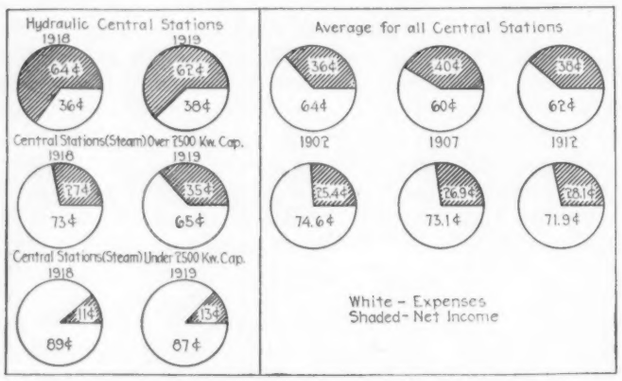


FIG. 1—MANUFACTURING AND DISTRIBUTION COSTS AND NET INCOME AVAILABLE FOR INTEREST AND DIVIDENDS PER DOLLAR OF INCOME FROM SALE OF ENERGY.

dividends, or, in other words, to obtain the operating ratio. In this survey operating expenses covered all expenses up to but not including interest on funded and floating debt. About 41 per cent of the industry responded to the questionnaires sent out, but the figures obtained were well balanced as to location, and as to capacity and character of stations.

In a consideration of the central-station industry, stations naturally fall into the following classes: Hydraulic, steam and gas plants of more than 2500 kw. rating, and steam and gas plants of under 2500 kw. rating. Tables I and II and Fig. 1 give the operating ratio for these three classes of stations, and also for the industry as a whole. The operating ratio of the hydraulic stations increased slightly during 1919, but the ratio of the steam stations both large and small, showed a decrease, especially the larger stations. The low operating ratio of the hydraulic stations is more apparent than real, for the original cost of a hydraulic plant and the interest of the funded debt is often more than enough to overcome the low cost of operation for several years.

The most significant result of this investigation is to be found in the average operating ratio curve for all central stations as shown in Fig. 3. After almost ten years of gradual increase the average ratio between income and operating expenses for the whole central-station industry has taken a downward turn. In the case of the larger steam and gas plants this downward tendency is very noticeable. A higher degree of scientific management, higher rates and a more efficient use of fuel are probably the direct causes of this bettered condition. Whatever the cause, however, it is apparent that the net income available for interest, amortization and dividends of central stations per dollar income are increasing after some ten years of decrease and that this branch of public utilities is, as a consequence, entering upon a new era of prosperity as a market for utility bond investors. This is all most gratifying to the electrical industry at large, for the central station is the mirror which reflects the prosperity of the entire industry.

THE YEAR 1919 SHOWS INCREASE OF 600,000,000 KW.-HR. PRODUCTION OVER 1918

Figures on output and revenue of central stations in the United States are available through October 1919. An estimate for the months of November and December, taking into consideration the coal strike and its resulting curtailment of electric power by orders of the Fuel Commission, gives an output for the year 1919 of approximately 30,300,000,000 kw.-hr. and a revenue of approximately $601,000,000. This is an increase of 600,000,000 kw.-hr., or 2.1 per cent, in output, and $70,000,000, 13 per cent in income over the year 1918. In the past three years the output has increased over 7,000,000,000 kw.-hr., or 32 per cent, while the income has increased $186,000,000, or 45 per cent. During 1918 the output increased 11 per cent, but this was during a period of intense war activity in all lines of industry, and the fact that after such a period a material reaction has not taken place is a clear indication of the healthy condition of the entire industrial life of the country.

Fig. 5 gives curves showing the revenue, manufacturing cost and net income available for interest and

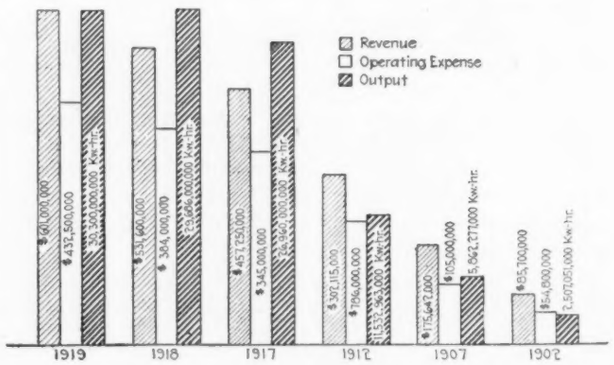


FIG. 2—REVENUE, OPERATING EXPENSES AND OUTPUT OF CENTRAL STATIONS, 1902-1919

dividends per kilowatt-hour of central stations. The revenue per unit gradually dwindled from 3.42 cents in 1902 to 1.79 cents in 1918, when a decided turn for the better took place, the revenue per kilowatt-hour in 1919 being 1.99 cents. The net income available for interest

TABLE I—OPERATING RATIO AND PROFITS PER KILOWATT-HOUR OF CENTRAL STATIONS

Year	Revenue from Sale of Energy		Manufact'g and Distribution Expenses	Operating Ratio, Expenses to Income	Output of Central Stations		Revenue per Kw.-Hr.		Manufacturing and Distribution Cost per Kilowatt-Hour		Net Income per Kw.-Hr. Available for Interest and Dividends	
	Million Dollars	Av. % Yearly Increase	Million Dollars		Million Kw.-Hr.	Av. % Yearly Increase	Cents	Av. % Yearly Increase or Decrease	Cents	Av. % Yearly Increase or Decrease	Cents	Av. % Yearly Increase or Decrease
1902	85.7	....	54.8	64.0	2,507	....	3.42	.....	2.19	.....	1.23	.....
1907	176.6	21.2	105.0	60.0	5,862	26.8	2.99	—12.5	1.79	—18.2	1.20	—2.4
1912	302.1	14.4	186.1	62.0	11,533	19.4	2.63	—12.1	1.62	— 9.5	1.01	—15.8
1917	457.2	13.2	345.0	74.6	26,960	26.8	1.86	—29.3	1.29	—20.4	0.57	—43.5
1918	531.6	16.2	384.0	73.1	29,686	11.0	1.79	— 3.7	1.29	0.0	0.50	—12.3
1919	601.0*	13.2	432.5	71.9	30,300	2.1	1.99	+11.0	1.43	+10.8	0.56	+12.0

* Estimated.

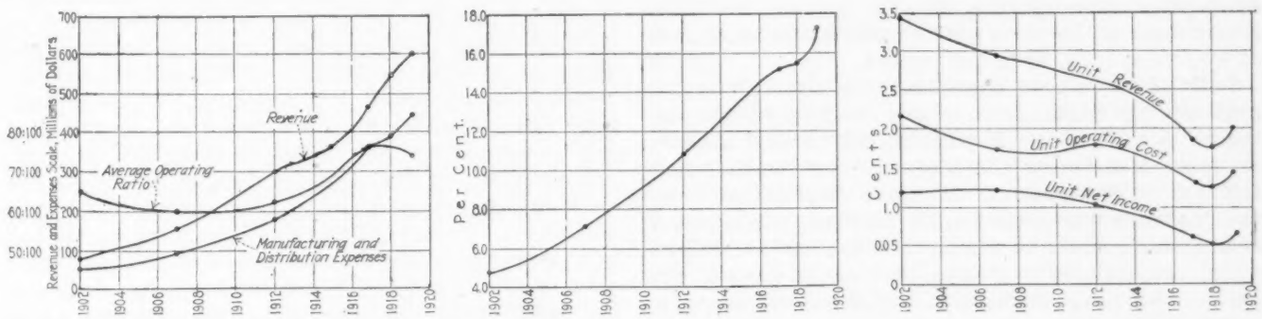


FIG. 3.—REVENUE, MANUFACTURING AND DISTRIBUTION EXPENSES, AND AVERAGE OPERATING RATIO OF CENTRAL STATIONS, 1902-1919. FIG. 4—RATIO OF VALUE OF ELECTRICITY GENERATED TO VALUE OF ALL MANUFACTURES, 1902-1919. FIG. 5—REVENUE, MANUFACTURING AND DISTRIBUTION COST AND NET INCOME AVAILABLE FOR INTEREST AND DIVIDENDS PER UNIT OUTPUT OF CENTRAL STATIONS, 1902 to 1919.

TABLE II—OPERATING RATIO OF CENTRAL STATIONS BY CLASSES OF STATIONS

Year	Hydraulic Stations		Steam Stations Over 2500 Kw. Rating		Steam Stations Under 2500 Kw. Rat'g		Entire Industry	
	Operating Ratio	Per Cent Increase or Decrease	Operating Ratio	Per Cent Increase or Decrease	Operating Ratio	Per Cent Increase or Decrease	Operating Ratio	Per Cent Increase or Decrease
1918	36.2	.....	72.6	.....	89.2	.....	73.1	.....
1919	37.8	+1.6	64.4	—8.2	87.6	—1.6	71.9	—1.2

and dividends per unit reached the lowest ebb in 1918—at 0.5 cent per kilowatt-hour. However, a gain of 12 per cent in this item during the past year should do much toward reinteresting the investing public in public utility securities.

Considered as a manufactured product, electricity is fast assuming a foremost position in this country. Table III and Fig. 4 clearly indicate the rapid rate at which the value of electricity generated is growing as expressed by the income derived from the sale of energy. In 1902 the ratio of the value of electricity generated to the value of all manufactures was 4.8 per cent, while in the short space of seventeen years this ratio has increased to about 17.2 per cent. It is doubtful if many other industries can show anything like such a comparative increase.

THE CENTRAL-STATION INDUSTRY BIDS FAIR TO BECOME ONE OF NATION'S VITAL ELEMENTS TO PROGRESS

In general these statistics indicate a wonderful growth of the central-station industry. From a mere cog in the industrial wheel it has grown in a very few years into one of the most important elements of that wonderful intricate machinery which has placed America first industrially among the powers of the world. With the immense undeveloped water powers of the West and the rapid conversion of prime movers from steam to electric, the central station bids fair to become, if it has not already become, the heart of the nation, from which flows the red blood that makes our industrial life the wonder and envy of the foreign world. All production, revenue and net-income curves point to a still further increase, while the unit cost of operation, seems to be relatively on the decrease. If this condition continues, and every available fact points in that direction, the electrical industry is destined for an immediate era of prosperity undreamed of heretofore.

TABLE III—VALUE OF ELECTRICITY GENERATED AND VALUE OF MANUFACTURES IN UNITED STATES

Year	Value of Electricity Generated (Gross Income)		Value of Total Manufactures in United States		Ratio Value of Electricity Generated to Value of All Manufactures in per Cent
	Million Dollars	Average per Cent of Yearly Increase	Million Dollars	Average per Cent of Yearly Increase	
1902	85.7	....	1,766.6	...	4.8
1907	175.6	21.2	2,415.0	7.4	7.3
1912	302.1	14.4	2,814.2	3.4	10.7
1917	502.1	13.2	3,295.4	3.4	15.3
1918	531.6	10.6	(Estimated) 3,417.7	3.8	15.6
1919	601.0(Est.)	13.2	(Estimated) 3,540.0	3.8	17.2

Power for Copper Refineries

Problems of Designing and Operating Two Large Plants, One Steam and Other Hydro-electric, in South America Outlined by Percy Thomas

SOME of the engineering problems involved in designing two South American power plants and some of the difficulties encountered in operating them after their erection were discussed by Percy Thomas in a very interesting lecture given before a meeting of the Association of Mining Engineers recently in New York. One of the plants is a steam station operated by the Chile Exploration Company, and the other is a hydro-electric development serving the Braden Copper Company. Experiences at the mines with electrical appliances such as electric shovels, were also related.

Both of the plants considered are situated on the west coast of South America, one at Chiquicamata and the other at Braden. Because of the unusual scarcity of water inland near Chiquicamata and the fact that fuel has to be imported, the Chile Exploration Company's station was erected on the seashore, where plenty of condensing water should be obtained, and the boilers, which are equipped with steel-tube economizers in the same casing, are provided with mechanical atomizers for burning fuel oil. To obtain pure make-up water for the boilers evaporators using live steam from the boilers are used, although Mr. Thomas said that he would advocate using exhaust steam from the auxiliaries if the plant were being built over. In this case, however, the auxiliary turbines exhaust into an early stage of the main turbines.

Owing to the ground swells on the Pacific Coast considerable seaweed accumulated in the condensing water tunnels at first so that a breakwater and revolving screen had to be installed. The transformers, which are rated at 110,000 volts, are equipped with head tanks full of oil so that there is no air space over the oil inside the transformer case and consequently no absorption of water. The oil is externally cooled in sea water, a plate of zinc being attached to the coils to prevent corrosion thereof by the seawater.

Duplicate 110,000-volt transmission lines are employed to convey energy to the copper refinery over the first 10 km., but the remainder of the line is single-circuit. A double circuit is used near the coast to permit washing off the insulators on one line every two or three weeks the salt that has been deposited by spray blown from the ocean. Although two-piece disks were employed, the insulators began to break down three or four years after being installed, and the "buzz-stick" method is now being employed to detect faulty insulators. From investigation it has been concluded that the principal insulator trouble is due to moisture.

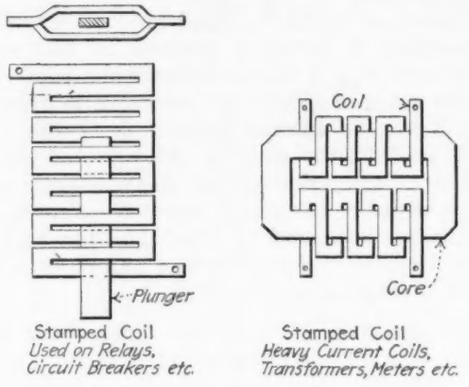
Electrolytic processes at the copper mine require that direct current at 120 to 290 volts be supplied, so 3,500-kw. converters with alternating-current boosters forming an integral part of them are used and fed from adjustable transformer taps. There are also two other converters which are fed from one transformer having two secondary windings. Alternating current is used for the five electric shovels which are now being employed, and they have been found very successful. Ten will be in operation shortly. To prevent an excessive overdrawing of current when a dipper takes too big a "bite," jamming relays are employed to insert resistance automatically. The cost of operating these electric shovels is much less than that of steam, according to Mr. Thomas, and they do all that the latter can do.

Electric power is also used for operating car dumpers, electric furnaces, electric crushers and magnetic separators, the most successful type of magnet used being the mushroom type. However, there is need of a more satisfactory magnetic head-end pulley.

Compared with the plant just described the station of the Braden Copper Company is a big contract. It is in a territory where there is plenty of water but too far from the coast to receive oil or fuel of any type economically. Therefore power is developed hydro-electrically. Development was very difficult, however, because of the shifting formation of the rock that makes it difficult to keep ditches clear of débris washed down with the water. Owing to the suspended matter in the water or to some peculiarity in the water itself the waterwheels are eroded very rapidly so that the replacement expenses of the plant are very high. In the plant just completed by the Braden company 80,000 cu.yd. (61,000 cu.m.) of gravel passed through the dam in one week so that the operating problem encountered should be obvious. Because of this condition a roller gate had to be employed in the dam instead of the ordinary type used in this country. To prevent excessive strains in the penstocks at the new plant, which operates under a head of 1,500 ft., a surge tank of two concentric cylinders is employed, the inside one communicating with the penstock. Between the two cylinders are small holes which restrict the flow of water from the inner cylinder to the other one, although they relieve the pressure in the penstock. The water flowing in the outer cylinder can be saved and utilized if desired. Although the operating conditions on the Chile Exploration Company's transmission line inland are very favorable, the Braden Company's lines are subjected to frequent lightning.

Solenoid Coils Are Made from Stampings

A COIL or solenoid formed by stamping or punching out of sheet metal strips which are alternately bent upward and downward is covered in United States patent No. 1,184,536, issued to Morris B. Kassel and Albert Finkenberg of New York City. It is especially intended for use as the coils of heavy-current or overload relays. Since it does not require any insulation or soldering of terminals it can very readily withstand heat. Being of rigid construction part of the stamping which forms the new coil can be used to mount insulating block containing contacts and supports for the plunger.



COILS PUNCHED FROM ONE PIECE OF METAL

Possibilities of Industrial Lighting

A Survey Shows Practically No Effort to Teach Executives the Benefits of Good Lighting—85 per Cent Satisfied, but Only 40 per Cent Have Good Illumination—Nearly One-third Made No Change in Five Years

By R. O. EASTMAN*

THAT productive lighting intensities are seldom found in factories is because about 90 per cent of the executives consider lighting as an expense, instead of an instrument of production. This condition was revealed in a very comprehensive investigation of representative industrial lighting conditions. In every case an effort was made to interview only executives, who it was found had been almost entirely neglected as far as lighting was concerned by the central stations and manufacturers. It was found that lighting improvements were in the largest measure dependent upon the advice and selling ability of the electrical retailers and jobbers.

According to the Illuminating Engineering Society's code 26.6 per cent of the plants visited required 0.4 to 0.6 watts per square foot (1000 sq.cm.), 34.6 per cent of the plants required from 0.6 to 1 watt per square foot, 33.2 per cent required from 1 watt to 1½ watt per square foot, and 5.6 per cent required a higher illuminating intensity. Compared with these requirements 40 per cent of the manufacturing plants had good lighting, but better illumination was needed by the other 60 per cent.

SCOPE AND METHOD OF INVESTIGATION

In conducting such a survey as this it was realized that the universal adaptability of the results depended more upon the proper selection of the plants visited than upon their number. The investigation actually covered 446 industrial plants in 57 different towns and cities throughout fifteen states in the chief industrial belt of the country. In order to make the investigation free from bias, non-technical investigators were chosen, and taught what they would be required to know about industrial lighting and the lamp business. Questionnaires were carefully prepared and committed to memory by each investigator so that the facts would come out in conversation with people interviewed rather than by direct questioning. The investigators were then tested on trial investigations before they were sent out on the survey.

An executive officer of the company was interviewed in forty-six per cent of the plants; the superintendent supplied the information for twenty-one per cent of the companies, and the electrician was the informant on twelve per cent of the calls. It was not found difficult to get the information, in fact the executives were very interested and seemed surprised that their lighting conditions could be discussed in non-technical terms.

The distribution of the interviews by population strata was as follows: Cities having a population of 100,000 or more, 47.4 per cent; cities of from 25,000 to 100,000 people, 31.2 per cent, and cities between 4500 and 25,000 people 21.6 per cent.

Plants in medium-sized towns were much more backward as a whole in their lighting installations than the plants in either the large cities or smaller towns. This is attributed to the fact that the large towns are obviously more actively canvassed by progressive lighting men, and many of the small towns are near the large cities, and profit by the lighting activity there. It is the medium sized towns some distance from the large cities, that seem to be especially neglected.

Dividing the plants according to their size, 14.4 per cent were classified as very large; 21.9 per cent large, 36.8 per cent medium, and 24.5 per cent were considered small. The larger plants were found to be better lighted than the smaller ones, and the executives of the larger plants were also better informed on lighting matters.

One of the most important revelations of the entire investigation is the overwhelming importance of the electrical retailer and jobber in industrial lighting mat-

FIG. 1—THE GLOOM AND DANGER OF LOCALIZED LIGHTING ARE BANISHED BY ADEQUATE GENERAL ILLUMINATION

*Presented before thirteenth annual convention of Illuminating Engineering Society.

ters, and the comparatively insignificant position occupied by the central station, the architect, the building engineers and lighting equipment manufacturers. Nearly 50 per cent of those interviewed said they would seek advice regarding lighting changes from an electrical retailer or jobber; 13 per cent would go to a consulting engineer or architect; about 9 per cent to the central station, about 15 per cent to some one in their own employ, and only about 6 per cent would ask the manufacturers for advice. Eliminating some others who were doubtful it was found that 72 per cent would go to the electrical distributor, or some one in their own organization for advice on lighting problems.

Another salient point brought out by the investigation is the widespread knowledge of the general benefits to be derived from better factory lighting as compared with the very little effort that has been made to improve conditions. The superintendents and chief electricians were very much interested in better lighting, and the plant electricians were surprisingly well informed. The interest of the executive officers, however, may be said to be of a latent or potential quality, and as a general rule the plant electrician did not seem

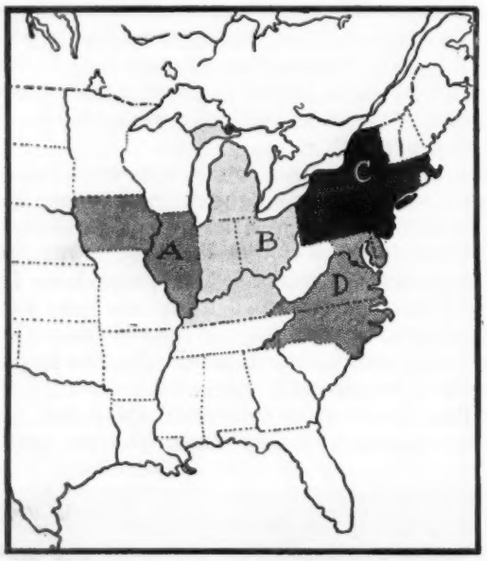


FIG. 2—TERRITORY COVERED BY THE INDUSTRIAL LIGHTING SURVEY

capable of impressing his ideas upon the plant executives. This seems to indicate that too little effort has been expended in showing the possibilities of productive lighting intensities to the executive officers of industrial companies. The importance of taking up such matters with an executive of the company is shown by the fact that in two-thirds of the plants visited the president, treasurer or general manager of the company authorized changes in the lighting system, and the purchase and installation of new lighting equipment. This lack of attention to the executive officers of industrial corporations may account for the fact that the largest percentage in table No. 7 is for plants which have not made any changes in their lighting installations for more than five years.

Reference to table No. 6 shows that only 11½ per cent of the manufacturers were dissatisfied or anxious to improve their lighting conditions, while over 30 per cent had either poor, partly poor or very poor illumination. About 85 per cent of the companies called upon were

TABLE I—MEN WHO AUTHORIZE PURCHASE INSTALLATION AND CHANGES OF LIGHTING EQUIPMENT

	Per Cent
President	22.3
Treasurer	8.5
General manager	36.4
Purchasing agent	20.4
Superintendent	10.7
Others	1.7

TABLE II—WEIGHT GIVEN BY INDUSTRIAL PLANTS TO ADVANTAGES OF GOOD INDUSTRIAL LIGHTING

	Per Cent
Increased production	8
Decreased spoilage	7
Prevention of accidents	6
Improvement of discipline	5
Improvement of hygienic conditions	4

TABLE III—WHERE INDUSTRIAL PLANTS SEEK ADVICE ABOUT LIGHTING CHANGES

	Per Cent
From electrical retailer	24.7
From electrical jobber	20.7
From consulting engineer or architect	13.2
From central station	9.2
From own electrician	7.1
From own engineer or architect	5.9
From own superintendent	1.6
From lamp manufacturer	6.1
From other manufacturers' engineer	0.5
From no one	1.9
From other sources or doubtful	9.1

TABLE IV—ATTITUDE OF INDUSTRIAL PLANTS TOWARD THEIR PRESENT LIGHTING

	Per Cent
Well satisfied	34.4
Fairly well satisfied	50.6
Disinterested	1.5
Doubtful	2.2
Dissatisfied	3.3
Anxious to improve	8.0

TABLE V—OBSERVED LIGHTING CONDITIONS COMPARED WITH I. E. S. CODE

	Offices Per Cent	Factories Per Cent
Excellent	19	.7
Good	36	32.1
Only fair	31	29.1
Poor	13	18.8
Very poor	1	3.5
Partly good and partly poor	1	7.8

TABLE VI—WHY NO CHANGE WAS MADE IN 30 PER CENT OF THE PLANTS IN PAST FIVE YEARS

	Per Cent
Satisfied	70.8
Best lighting not required	7.9
Slow getting started	6.7
Intended to move	4.5
Never thought of it	3.4
Miscellaneous	6.7

TABLE VII—TIME OF LAST LIGHTING CHANGE 39 PER CENT OF WHICH WERE PLANNED BY LOCAL DEALERS

	Per Cent.
Within one year	14.6
One year ago	13.4
Two years ago	20.2
Three years ago	10.6
Four years ago	11.1
Five years ago	5.9
More than five years ago	24.2

more or less satisfied with their existing lighting conditions, although only about 40 per cent of the plants visited were adequately illuminated.

It was found that 69 per cent of the plants purchased their light and power service, and that 37 per cent produced all or part of their own light and power requirements. This shows that 6 per cent of the plants produced some service and purchased part of their require-

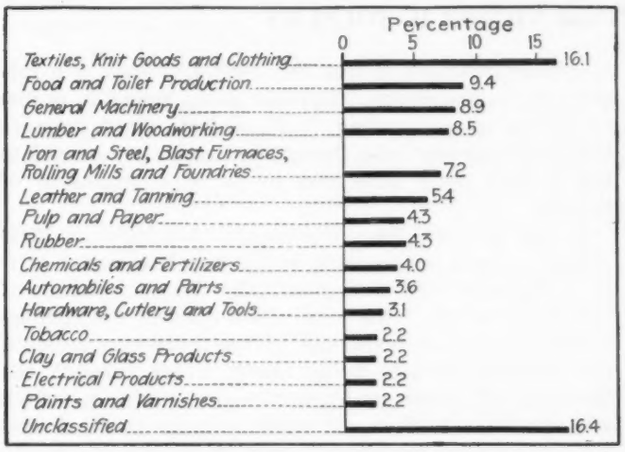


FIG. 3—DISTRIBUTION OF INTERVIEWS OF KIND OF BUSINESS

ments. In spite of the fact that central stations supply service to over two-thirds of the plants investigated, the utilities are anything but a potent factor in the development of industrial lighting, as will be shown by referring to table No. 3. Only 9.2 per cent of the manufacturers seek lighting advice from the utility, while 45.2 per cent go to jobbers and retailers. There were many empty sockets in fifty plants, a few in 136 plants and no empty sockets in 103 plants. Central station service was used by 62 per cent of the plants which had many empty sockets, 71 per cent of those with a few empty sockets and 70 per cent of those with none.

Of interest to manufacturers is the report that only about 60 per cent of the men interviewed knew anything about the gas-filled incandescent lamp, and only 15 per cent had heard of the "daylight" lamp. The vacuum-tungsten lamp was known to nearly 90 per cent of the men called upon.

Dividing the plants on a basis of the extent to which reflectors were used, one-sixth used reflectors throughout, and a slightly larger percentage used none at all. About one-third used reflectors extensively, and almost the same number used them to some extent.

Water-Power Development Appropriations in Norway

United States Consul General Marion Letcher writes from Christiania that the Norwegian budget for 1918-1919 contained an item of 22,250,000 crowns ($5,963,000) to be expended by the government in the development of water power, in addition to 1,000,000 crowns ($268,000) appropriated under special acts for the improvements of the Norefaldene. Of the above amount 15,125,000 crowns ($4,053,500) was expended in the acquisition of the Glomfjord waterfall. The corresponding appropriation in the budget for the present fiscal year is considerably larger, totaling 29,972,000 crowns ($8,032,496).

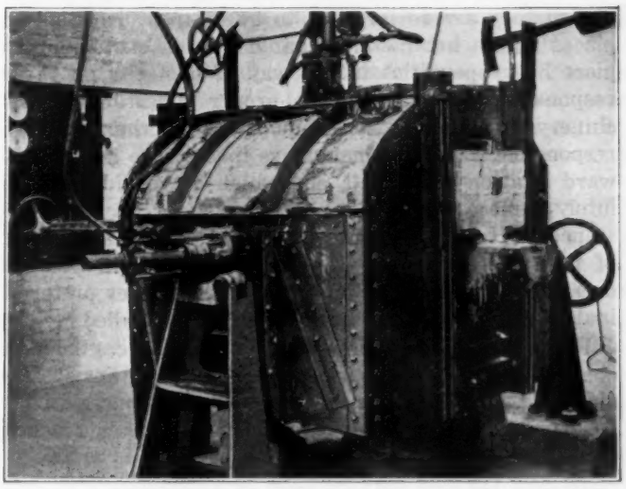
Electric Furnace for Experimental Use

Hand-Fed Carbon-Arc Furnace Utilizes Scrap Otherwise Non-Usable, Producing Steel with 2.8 per Cent of Carbon

THERE is considerable demand for special grades of cast iron—for instance, iron which is resistant to acids—and the necessity of experimentation to produce these results is so constant that the Pacific Foundry Company of San Francisco has found it expedient to install an electric furnace for this purpose alone. Cupola furnaces have hitherto been depended upon, but it was found that the two-phase Rennerfelt furnace of 750-lb. (340 kg.) capacity, which has been installed, is capable of using bits of iron scrap which could not be utilized in the other furnaces.

Even with the bits of waste, iron nails, borings and the like which are used as a base, it has been found that an iron of very desirable qualities is produced. The electric furnace burns out some of the carbon, resulting in a lesser quantity in the cast. A typical iron has about 2.8 per cent carbon and varying amounts of other elements.

The furnace is provided with three electrodes, the top one of the three-wire two-phase system of power supply, while the two side electrodes are connected to outside wires. A hand wheel is provided at the side, by which the electrodes are fed in at need. Electrodes are made in sections, so threaded that the new section may be screwed onto the old—a significant item in the economy of carbon. A large hand wheel controls the dumping, which pours through a gate at the end, and water connections keep the jacket



CARBON ELECTRODES ARE FED INTO FURNACE BY MEANS OF HAND WHEELS

cool. Power is used at 11,000 volts from the Pacific Gas & Electric Company's system.

The electric furnace has hitherto been used largely for steel, but recent experiments performed at Columbia University on iron castings made in the electric furnace, confirm the satisfactory results here indicated. The strength of these castings was found to range from 40,730 lb. to 45,030 lb. per square inch, (2,850 to 3,152 kg.), a result considerably higher than records achieved with ordinary cast iron.

Fuse Protection for Branch Conductors

A Less Troublesome and Less Expensive Yet Safe Method of Installing Branch Line Fuses in Large Industrial Plants Is Recommended—Curves for Short Time Rating of Conductors Are Worked Out

By HENRY C. HORTSMANN and VICTOR H. TOUSLEY

THE common method of installing mains and branch conductors for electric light and power in such places as steel mills, foundries and large machine shops is to run conductors of heavy capacity near the ceiling, where they are as far as possible out of the way of mechanical injury. These wires are often run open, and some insulation other than rubber is often used. The majority of such installations are subject to more heat than rubber insulation is supposed to stand very long. From these mains, installed in a more or less inaccessible place, taps for individual motors or groups of lamps and motors are brought down in conduit, either along the side wall or along some column within the building.

In order to bring this method of construction within the rules of the National Electrical Code it is necessary either to drop down with conductors of the same current-carrying capacity as that possessed by the mains or to install fuses where the size of wire is reduced. To drop down with such heavy wires to supply only a small motor, is very troublesome and also is expensive. To install a set of fuses high up above the floor at the junction is also troublesome and is in addition conducive to much loss of time in case the fuse blows. In the vast majority of cases where such fuses have been installed they are so large as to be entirely useless. In places where hot metal is handled it is customary to place heavy penalties in the way of demerits on those responsible for delay in the proper operation of machinery. For this reason alone, if for no other, the man responsible will often make sure that a fuse in an awkward location—above all, one which he considers absolutely unnecessary—will not blow under any circumstances. He thereby succeeds in dodging the question of fuse protection for the conductor but still lives in dread of loose contacts or screws in the fuses or terminals, or in "jumpers" he has perhaps installed.

From the point of view of the operating engineer in charge of such places, permission to connect taps of considerably smaller capacity than the main and without fuse protection until the translating device is reached is a great boon, and it is the purpose of this article to show how far this may perhaps be granted.

Fig. 1 is a diagrammatic sketch of the manner in which branch conductors are usually installed. The taps leave the mains and enter the conduit through porcelain protection which gives assurance that no trouble will occur at this place, or at least none that would not exist as well if the fuses were installed there. The wires are then led down in conduit to a metal cabinet within easy reach of the floor. At the present time this cabinet often takes the form of one of the well-known safety switches, which make it impossible to gain access to the switch or any live parts inside without first disconnecting the whole line. In all modern shops of the type referred to, automatic remote control is usually provided so that this switch is used as a rule only in an emergency. Even in cases where it is disconnected every evening it is seldom called upon to break any current, and therefore it may be expected to last a very long time and to cause a minimum of trouble.

It can be seen from the sketch that there is little chance of trouble occurring on the tap line as far as it is in the pipe, and that practically the only chance of trouble is found at the lugs which connect the conductors to the switch terminals. Here there is a possibility of short circuits being made, either through the loosening of screws or by workmen changing a switch while the line is alive. It must be borne in mind that a fuse is always installed in connection with the safety switch and that this fuse is ample protection against any overload due to the motor on the branch wires, so that the only condition that really needs to be guarded

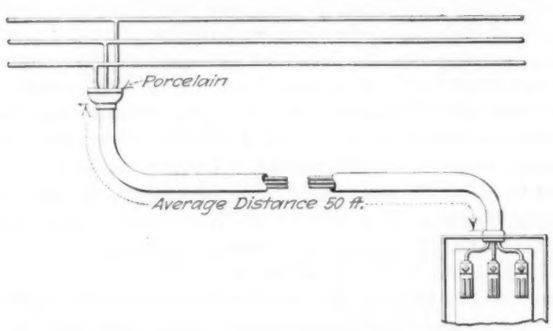


FIG. 1—USUAL METHOD OF INSTALLING BRANCH CIRCUITS

against is a short circuit. The chance that a ground of such a nature as to put a limited overload on the circuit ahead of the motor fuses may come on and thus overload the lines, say 200 or 300 per cent, is too small to be seriously considered.

CONSIDERATIONS IN OMITTING FUSES

In order to make it safe to connect a small wire as a branch conductor to a larger one without providing fuse protection at the point where the change in size is made, two points must always be considered—first, the small wire must be able to stand the heating due to a short circuit which will draw enough current to blow the fuse or to operate the circuit breaker in the larger conductor; second, the total resistance of the line must also be low enough to allow the current to rise to this value in case a short circuit is made. The chief danger lies in the possibility that the current following a short circuit may not be strong enough to open the main circuit at once. Thus a long line or a long branch of small wire is at a disadvantage in this respect. This fact has been taken into consideration in Table II, and no branch

circuits have been considered unless the current that would result from a short circuit made at the terminals of the small wire would exceed the normal current of the larger circuit by about 500 per cent. In this case, however, the calculations were based on a line voltage of 220 and a run of mains 1000 ft. (304 m.) long [2000 ft. (609 m.) of wire], while the taps were assumed to be 100 ft. (30 m.) long [200 ft. (61 m.) of wire]. This represents probably the hardest conditions that will be encountered.

SHORT TIME RATING OF CONDUCTORS

In Table I are given the current values which the various conductors listed there can carry for five seconds, ten seconds, fifteen seconds and thirty seconds.

TABLE I—CARRYING CAPACITY OF WIRES FOR VARIOUS LENGTHS OF TIME

Wire, B. & S. Gage	Time in Seconds				
	5	10	15	30	1
14	220	155	125	90	45
12	270	192	155	112	60
10	410	285	235	168	75
8	560	400	330	235	105
6	775	540	440	318	150
4	1130	800	660	520	210
3	1510	1060	875	615	240
2	1630	1140	945	670	270
1	1940	1370	1125	795	300
0	2580	1820	1485	1050	375
00	3015	2120	1740	1230	450
000	3780	2675	2175	1540	525
0,000	4250	3030	2450	1750	675
300,000	6350	4535	3435	2600	825
400,000	6930	4950	4000	2840	975
500,000	9240	6600	5350	3800	1200

These carrying capacities were estimated in the following manner: A curve depicting the temperature rise due to a heavy overload appears practically as a straight line assuming the temperature does not approach the steady or final value; temperature being plotted vertically and time horizontally as at the left in Fig. 2.

The rise in temperature is, furthermore, approximately proportional to the square of the current used, and where heavy overloads are considered it is also almost independent of the surrounding conditions; *i. e.*, it matters very little whether the conductors be incased in conduit or run open. It follows from these considerations that if *c a* be a "curve" of temperature rise due to some current *i* it is possible to find the curve corresponding to any greater current *I* by laying out a length *b f* proportional to I^2 along line *b a* and then drawing the line to *c f*. Since the time necessary for *i* to cause the temperature rise from *c* to *e* is that represented by the line *e a* ?, it follows that the line *e d* will indicate the length of time required by *I* to cause the temperature rise *c e*. It is possible to use the same construction also to find the current that would cause a certain temperature rise in any given time by first laying out the time along *e a* and drawing a line from *c* through this point until it intersects *a b*. The current in question, *I*, will then be equal to the square root of the term T/t multiplied by *i*, where *T* stands for the length of the projected line as *b f*; *t* for the length of the line *c e*, and *i* for the current required to cause the temperature rise represented by *c e*.

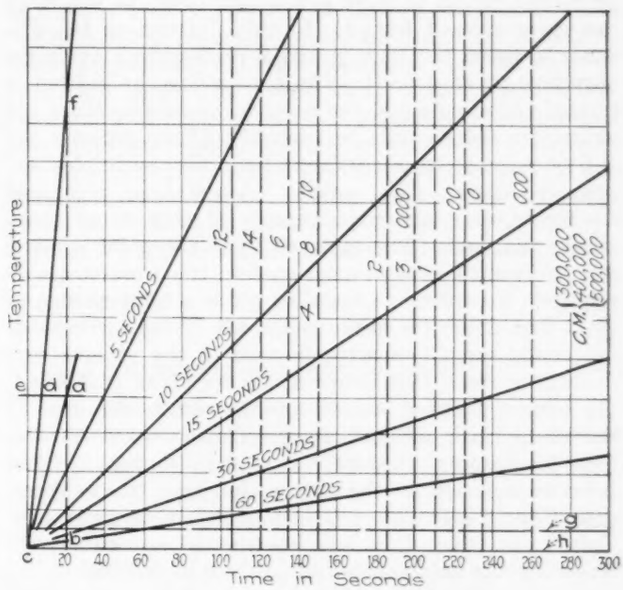


FIG 2—TEMPERATURE-TIME CURVES

For the determination of currents a conductor of given size will carry for short periods with a temperature rise of 40 deg. C.

Now, in order to apply this method of determining the carrying capacity of conductors for heavy overloads of short duration to all conductors, the diagram may

TABLE II—SIZES OF WIRE FOR BRANCH CIRCUITS THAT MAY BE CONNECTED TO LARGER MAINS WITHOUT FUSE PROTECTION

Small wires will stand 400 per cent overload of large wire for time given at top of column and not exceed a temperature of 40 deg. C. Data are for rubber covered branch wires in conduit.

Size of Main	Mains of Rubber Insulation					Mains of Other Insulation				
	Amperes	5 Sec.	10 Sec.	15 Sec.	30 Sec.	Amperes	5 Sec.	10 Sec.	15 Sec.	30 Sec.
2,000,000	1050	0000	300,000	500,000	.....	1670	400,000	600,000	.....	.....
1,750,000	950	0000	300,000	400,000	.....	1520	300,000	500,000	.....	.....
1,500,000	850	000	300,000	400,000	500,000	1360	300,000	500,000	.....	.....
1,250,000	750	000	300,000	300,000	500,000	1185	300,000	400,000	500,000	.....
1,000,000	650	00	0000	300,000	400,000	1000	0000	300,000	500,000	.....
750,000	525	0	000	0000	300,000	800	000	300,000	400,000	500,000
500,000	400	1	00	000	0000	600	00	0000	300,000	400,000
400,000	325	2	0	00	000	500	0	000	0000	300,000
300,000	275	3	1	0	00	400	1	00	000	0000
0000	225	4	2	1	0	325	2	0	00	000
000	175	4	3	2	1	275	2	1	0	00
00	150	6	4	3	2	.....	.....	.....	.....	.....
0	125	6	4	4	3	.....	.....	.....	.....	.....
1	100	6	6	4	4	.....	.....	.....	.....	.....
2	90	6	6	6	4	.....	.....	.....	.....	.....
3	80	6	6	6	4	.....	.....	.....	.....	.....
4	70	6	6	6	6	.....	.....	.....	.....	.....
6	50	6	6	6	6	.....	.....	.....	.....	.....

be reconstructed in more convenient form, as shown at the right side of Fig. 2. In this illustration the distance between the lines *g* and *h* represents a temperature rise of 40 deg. C. The time along the bottom is plotted in seconds and the diagonal ascending lines are drawn for five seconds, ten seconds, fifteen seconds and thirty seconds in accordance with the principles explained before. The various vertical lines represent conductor sizes, the gage number of each being given on the diagram. The distance from the point *c* along *c h*, is in each case proportional to the time which is required, according to tests, to reach a temperature of 40 C. deg. above the surrounding air in the corresponding conductor. The currents used in the various conductors to reach this temperature are given in Table I, (in column under *i*) as are also the results obtained by the calculations outlined above. Thus it takes 120 seconds for 45 amp. to raise No. 14 wire 40 deg. C. The formula is based on the assumption that the temperature rise is correctly represented by a straight line. This is not true. It is well known that any curve representing the values obtained in tests is in itself an interpolation of data, and that no one point on the curve can be taken as absolutely correct. This is especially noteworthy with curves representing very rapid rises in temperature. Therefore, in order to safeguard against all possible errors of this kind the time plotted along the bottom in seconds is taken as just half of that actually found in tests for the rise from 0 deg. to 40 deg. C. This, it is believed, will make the results given quite safe to apply in practice.

AN EXAMPLE OF POSSIBLE SAVING

As an illustration of the saving that may be effected by the use of the smaller wire in place of the larger the following actual case may be considered. In a certain large manufacturing plant there are four runs of 500,000-circ. mil. cables of two wires each operating at 220 volts direct current. The insulation is weatherproof and, according to the National Electrical Code, the cables have a carrying capacity of 600 amp. each. The nature of the business at this plant is such that a demand factor of 50 per cent is permissible according to the rules of the power company so that the connected load may be equal to 1200 amp. This is equivalent to 320 hp., and that load therefore could be connected to the mains through eight runs of No. 00 cable, each good for 40 hp.

Rubber-covered wire in conduit is used for the branch circuits. The circuit breaker in this case might allow the current to rise to more than 3000 amp. before operating and still protect the No. 00 wire. It is customary in installations of this kind to set the circuit breakers so that they will not operate very often. If one should open twice in one month, it would probably be set for a greater current strength.

Each run of branch circuits in this installation is about 100 ft. (30 m.) in length, and the cost of installing two conductors of 500,000-circ. mil. capacity in 3-in. (7.5-cm.) conduit is given as $250 each, while the No. 00 cables may be placed in 2-in. (5-cm.) conduit at a cost of only $115. Thus it is possible to effect a saving of $135 per branch, or $1,080 on each set of mains, or $4,320 on the whole installation. Moreover, the fuses would be more conveniently located and the installation can be reasonably safe.

Operation of the Meter Department in Scattered Territory*

Each Division Responsible for Testing, Installing and Maintaining Meters, but Central Standardization Laboratory Is Maintained

WHERE the area served by a central station is large and where the consumers are widely scattered, the meter department cannot be operated efficiently from a single location. For this reason several well-defined divisions must be established, each with its meter department to be responsible for testing, installing and maintaining the meters within its division boundaries. These meter departments should operate as a single unit, however, to avoid duplication of expensive equipment and men with specialized training, to obviate keeping stocks of large-sized meters, instruments and repair parts at a minimum, to give all division departments the services of a meter laboratory with an operating force adequate for their needs, and to standardize methods, equipment and policy.

To carry out this method a supervisor should be appointed and a standardization laboratory created. The supervisor should have complete supervision over all meter work. The standardization laboratory should be independent of any division department operated directly under the meter supervisor and should include standardizing facilities, a repair and construction department and a stock department for meters and instruments. The standardizing laboratory should be equipped with all primary, secondary and precision standards, with auxiliary apparatus necessary to perform its duties efficiently. The repair and construction department should be equipped with a complete outfit of precision tools, coil-winding machines, coil-baking ovens and other equipment necessary for making, repairing and tuning-up instruments and meter parts or coils. The stock department must carry an adequate stock of repair parts of all kinds.

Power-house and substation meters and instruments, meters of all customers having over 750 kw. load and all indicating instruments in customers' substations should be tested and maintained by a tester and assistant reporting to the standardization laboratory. This is necessary on account of the special instruments and equipment required.

The division departments should obtain instruments and transformers from the laboratory for their immediate needs by means of requisitions, but the stock department must be prepared to make immediate shipment upon receipt of these requisitions. Emergency requirements can be suitably met by accepting telephone orders. This method not only insures the division departments against issuing inaccurate or otherwise unsuitable instruments and transformers but enables the entire system to be served from a much smaller stock.

Requirements for meter locations, methods of testing, periods of tests of meters in service, methods of investigating complaints, training and instructing new men, forms of meter record and other standards necessary in meter work, system of filing, etc., should all be standardized by means of general instruction orders issued by the meter supervisor.

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*Excerpts from paper presented by E. H. Tyson of the Lehigh Valley Light & Power Company, Allentown, Pa., before the twelfth annual convention ofthe Pennsylvania Electric Association.

The division departments, each operating under its meter superintendent or foreman, conduct periodic tests according to a standard schedule and standardized methods and make repairs on meters and instruments which can be accomplished by ordinary meter testers or demand maintainers without special equipment or training in repair work.

The division meter rooms should be located in the largest cities and towns with locations as central as possible to division territory and with best transportation facilities to surrounding towns.

Where meters are situated a considerable distance from the division meter rooms district meter rooms must be established in order to reduce transportation costs and the possibility of injuring testing meters in transit. In other districts, where there is not enough work to require the continuous services of either a tester or an installer, one man should be trained to do both classes of work and also to maintain the few recording demand instruments in the district. District meter rooms must be provided with test boards for testing meters according to standard methods and should maintain an adequate stock of new low-capacity meters and such repair parts as may be required to replace parts which are worn during the course of ordinary test.

Meters scattered along the distribution lines outside of any district should be tested periodically by meter men using automobiles and who can report at the beginning of each work day to the division meter room.

Readers' Views and Comments

Method for Determining Customer's Average Power Factor

To the Editor of the ELECTRICAL WORLD:

SIR: Lack of reliable data is no doubt in a measure responsible for the deficiency of cost figures relating to high percentages of reactive kva. in consumers' installations; that is, with respect to tabulations obtainable of conditions as they exist in cases of average and extremely low power factor.

A means is suggested by a well-known fact in connection with metering polyphase loads that seems to offer a method quite inexpensive for determining the consumer's average power factor. When two single-phase watt-hour meters are used on a three-wire, three-phase system the readings of the two meters must be added algebraically in order to arrive at the total kilowatt-hours registered. In a case of power factor as low as 50 per cent, meter *A* would not register, while meter *B* would register the entire amount, and at less than 50 per cent, meter *A* would rotate backward and would have to be deducted from meter *B*. This at once suggests that the ratio of the readings of the two meters would be an index of the average power factor prevailing during the period of registration, and the use of a relatively simple calculation would readily give the result desired.

It is true that this method would not give the hour of the day that high reactive factors prevailed, but it is argued that diversity would be found eventually to take care of this matter. Moreover, in the case of relatively large consumers, individual surveys would be justifiable such as are the practice in the case of maximum demand determinations if it is desired to arrive at effects produced on the central station at any particular time of day. This method also is applicable to three-wire, three-phase systems only; but it is believed that the great majority of cases are of this type.

B. H. FREELAND,

Attica, Ind.

Supporting Educational Institutions

To the Editor of the ELECTRICAL WORLD:

SIR: I have read with interest the leading editorial in the Jan. 10 issue and feel that you have done a great service in calling attention to the service situation confronting our educational institutions because of lack of financial support.

The effects of the insufficient salaries of our college instruction staffs should be cause for serious alarm to the industries of the country. An insidious process of deterioration is taking place in our university faculties. Able teachers are leaving for more remunerative work outside, and able and ambitious men are not attracted by the rewards promised by the profession. At some period not so far in the future we shall find ourselves a nation whose universities do not rank better than third rate.

The universities put on the market a human product that is essential to industry—essential not only in positions of leadership but in an infinite number of positions of responsibility. Though it may be argued that many self-trained men have reached the top of the engineering profession, still it must be admitted that their number would soon fall short of the requirements of the age. More efficient methods of producing engineers are imperative.

The colleges endeavor to train men to think correctly, to work logically, to use as the basis for their work fundamental truths, to apply these in proper sequence, to make intelligent assumptions for supplementing exact data, to leave nothing untried in the effort to reach the correct solution, to be unprejudiced, critical, accurate. That the universities fail to do this in many instances is undeniable, but that this is their ideal is also undeniable.

Men of such training will solve the problems brought about by competition, intensive production, the ever-increasing needs of the human race. They will apply their training to produce greater efficiency and greater economy in present methods and to devise new processes that must come to further our civilization. They will grasp the new problems and will solve them.

The engineer is a necessity of modern life. His method of thought leads the way to progress. We must equip him with the inspiration of the best teachers. Can we afford to intrust our engineering apprentices to inferior workmen and equip them with inferior tools? It is the part of the industries of this country and of their leaders to see to it that something be done immediately to make the teaching profession in our universities desirable to the present incumbents and attractive to our ablest young men.

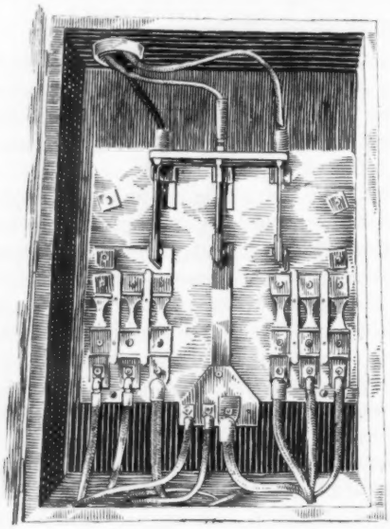
Detroit, Mich. P. O. REYNEAU.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Special Switch for Several Sets of Service Mains

IN THE illustration below a special design of switch as far as the fuses are concerned is shown which has been developed by a Middle West company and so arranged that four sets of service mains may be connected to it. Such mains are run to busbars which are



SERVICE SWITCH WHICH PERMITS EASY LOCALIZATION

protected by fuses. In this way in case of trouble all customers depending on the service switch will not be inconvenienced, for the particular mains which are involved can, by means of the fuses, be disconnected and the trouble remedied.

These switches, which are installed in galvanized-steel cabinets of No. 12 U. S. gage, act as the service switch for all customers connected on a particular set of a company's service cables. They are made in three sizes, 100 amp., 200 amp. and 400 amp.

Stippled Globes Improve Incandescent Street Lights

THE use of stippled or rippled outer globes with dome refractor lends sparkle to the pendent incandescent street lighting units at Niagara Falls. In describing this application in a paper read before the Illuminating Engineering Society's thirteenth annual convention A. D. Cameron and C. A. Halvorson pointed out many other advantages of the combination.

Compared with the bowl refractor, the stipple globe and dome refractor combination gives about 15 per cent more lumens and has only one surface exposed to dust and smoke instead of three. Its distribution curve shows that the combination gives 200 per cent more light directly under the light, 100 per cent more light at an angle of 45 deg. and only 15 per cent less light at an angle of 10 deg. The stippled globe alone was said to give an efficiency of 15 per cent to 30 per cent higher than the ordinary diffusing globe and to permit the use of a dome reflector for street lighting which will give three times the light at points midway between lamps.

Dispatching Method for Operating Boiler Plant

WHEN the quantity of steam needed varies greatly from time to time, the rate of production cannot be changed quickly enough in a plant with numerous large boilers to insure an adequate supply at highest boiler efficiency. Furthermore, steam required for any load curve can be produced by various combinations of boilers at different ratings, and the selection of the best combination is important.

To enable advantageous operation of boilers on a load which is subject to wide differences in daily requirements for energy, a plan has been developed for the Ashley Street plant of Union Electric Light and Power Company, of St. Louis, which is as follows:

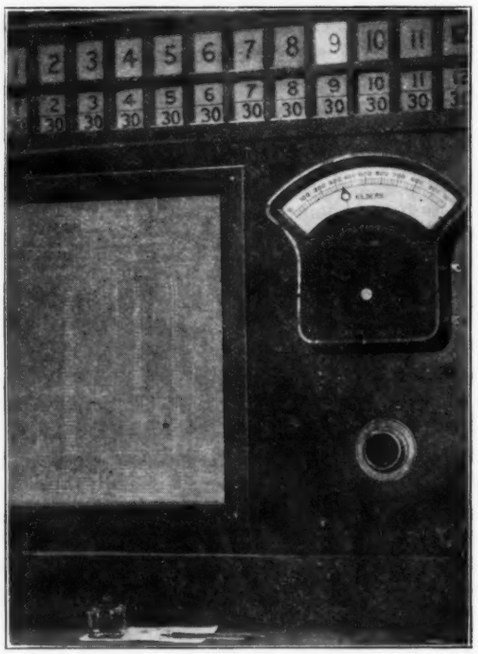


FIG 1—BOILER ROOM DISPATCHING BOARD AT OPERATOR'S CONTROL DESK

The number of "kilbers" shown on the "kilberscope" here and on the one in the boiler room is regulated by the handwheel under the instrument. The illuminated figure near the top of the board gives the time when the "kilbers" will be required. The framed tabulations to the left give the number of "kilbers" required for any load with different turbo-generator combinations.

The need was felt for a unit which was common to both prime movers and boilers and the name "kilber" was devised to stand for 1000 lbs. of steam per hour (450 kg. per hr.). It is a combination of "kilo"—one thousand, and "lb."—pounds, with the euphonic abbrevia-

tion "er" representing "per hour". Since the adoption of this name, the terms "kilowatts" and "boiler-horsepower-hours" are seldom heard in the boiler room. The steam flowmeters are now calibrated to read directly in "kilbers."

The system load dispatcher forcasts the load requirements and instructs the steam plant operator what load, in kilowatts, will be required from that plant one half hour later. The quantity of steam in "kilbers" which will be needed for that load with different combinations of turbo-generators is shown by a glance at the chart at the left in Fig. 1. The operator then orders from the boiler room the proper number of "kilbers" for delivery at a designated future time.

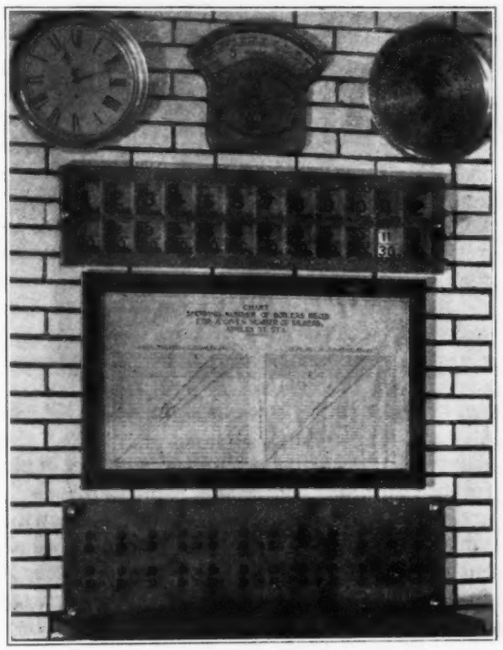


FIG. 2—SIGNALING BOARD IN BOILER ROOM

The "kilberscope" and time indicator are similar to those in Fig. 1. The chart here gives the output in "kilbers" from boilers in each of two groups when operated at different percentages of their rated capacity.

The apparatus for signalling orders and acknowledgments between the switchboard gallery and the boiler room is simple and effective. A circuit, containing a rheostat, runs from the operators control desk to the boiler room and connects two illuminated dial voltmeters graduated in "kilbers." These "kilberscopes," as they are called, are mounted near time indicators which have 24 separately illuminated compartments numbered to correspond with the hours and half-hours.

The operator's control desk, the rheostat wheel below the kilberscope, and the time indicator above this instrument are shown in Fig. 1. When this photograph was taken 340 kilbers had been ordered for nine-o'clock. Having set the "kilberscopes" at the desired reading, the operator closes a circuit which illuminates a compartment of the distant time indicator and actuates a claxon alarm in the boiler room. The alarm continues to sound until the boiler room attendant closes a circuit which illuminates a corresponding compartment for the time indicator at the control desk, thus acknowledging the order. The apparatus shown in Fig. 2 is installed in the boiler room. The illustration shows that 265 kilbers will be required at 11.30. The chart shown in the illustration gives the "kilber" output of the boilers in each group when operating at different percentages of their rated capacity.

This system eliminates the use of an unnecessary number of boilers under bank or operating at reduced capacity. It reduces the probability of misunderstanding between boiler room and turbine operators, and is a convenient means of placing the load dispatcher in more effective control of results. The economies produced have been important and have stimulated the plant employees to greater efforts to add to their bonus earnings by effecting further economies with the use of this new tool.

Automatic Ship Hoist Conveys Coal to Bunkers

COAL for the plant of the United Light & Railways Company, Davenport, Iowa, is brought into drop-bottom cars which empty into two track hoppers 14 ft. (4 m.) wide by 28 ft. (8 m.) long. A motor-driven apron conveyor with a capacity of 70 tons per hour delivers the coal either to the crusher or direct to cross-conveyor belts, which in turn discharge to another belt, carrying the coal to a 2-ton skip hoist at the end of the boiler house. The hoist is a standard passenger elevator type driven by a 35-hp., two-phase, 400-volt motor. It is so arranged that its control can be either automatic or manual. The skip car travels from the loading position to the dump position, a vertical distanct of about 108 ft. (33 m.) with full load at a speed of 225 ft. (69 m.) per minute, and with an ultimate capacity of 80 tons per hour.

In the loading position the skip bucket rests on a compression spring adjustable for different loads. When the spring compresses to the desired point a contact is made actuating a relay which closes the cut-off valve controlling the coal feed from the hopper supplying the bucket. On closing, the valve actuates the starting relay for the hoist. The bucket is elevated to the dumping position, empties and returns to its original position, automatically opening the hopper valve to refill the bucket with coal. It repeats the same cycle as long as the coal-handling operator desires automatic operation.

Some of the Practices of a Transmission Company

ON ITS system, which has 100,000 kva. back of it at a distance of 15 miles (24 km.) from the generaing station, the West Penn Power Company of Pittsburgh, Pa., has found that the horn gap is adequate to break the current on the line when transformers are short-circuited. Branch lines are not fused. It has been found that the use of core-type transformers is an advantage in case of trouble because they enable voltage to be applied to the line so that the defective apparatus can be traced through the burning which will result.

On certain circuit-breaker-protected transformers there was a failure which could not be located without applying almost full voltage to the transformers. The transformer was simply out of oil, and the experience proved rather costly.

In addition, it is difficult to obtain the lesser voltage at points where transmission voltage is available. With

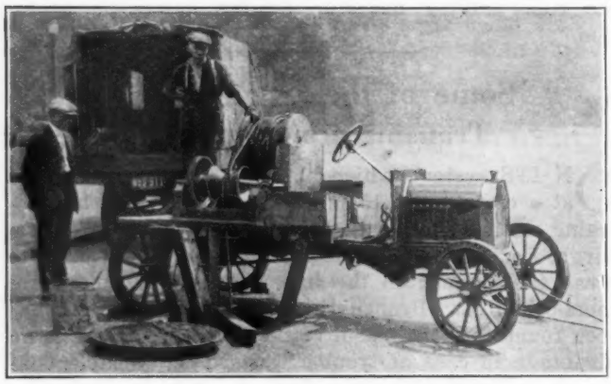
the fuse, however, the coil which is in trouble is easily found and the replacement made in the field. In wet weather when repairs are made in the field a tarpaulin in the form of a circular tent with readily removable sides which snap into place is thrown around chain blocks used for lifting the core and main parts of transformers. This covering protects the transformer and the men that work on it. Field-repair work can be done on core-type transformers only, the shell type being too intricate.

A. W. CARTWRIGHT,
Superintendent of Construction.
West Penn Power Company,
Pittsburgh, Pa.

Cable-Pulling Device Made from a Ford Car

BY SIMPLY attaching a pulling winch to a Ford car and connecting it to the driving shaft of the engine the Buffalo General Electric Company has obtained a dependable and speedy cable-pulling apparatus. The trouble sometimes experienced with apparatus which uses a one-cylinder or two-cylinder gas engine for motive power and the limitations of storage batteries when electric motors are used have been obviated. To pull the large cables which are in service in Buffalo only 4 hp. to 7 hp. is needed. Thus ample power is provided, because the Ford engine develops 12 hp. when operating at 1,000 r.p.m.

The cable-pulling winch is connected to the driving shaft of the motor by means of a 2-in. (5-cm.) Morse chain. When the engine is operating at 1,000 r.p.m. the cable will be pulled at 60 ft. (18 m.) per minute. Of course the speed control of the car is fully utilized for cable pulling. The winch and pulling rope weigh about 700 lb. (300 kg.). By placing blocks under the frame as shown in the illustration the wheels or chassis are not subjected to undue strain. The blocks of this motor have been in a Ford car which has traveled over 100,000 miles (150,000 km.). In fact, everything entering into this apparatus with the exception of the winch and rope was taken from the scrap pile. The cost of the pulling device complete was only $300.



FORD CAR UTILIZED TO PULL UNDERGROUND CABLE

Already this apparatus has pulled about 50,000 ft. (150,000 m.) of cable. A section has been pulled in twelve minutes which previously took ten men on a hand winch four hours.

WILLIAM HEMPHILL,
Assistant Superintendent of Distribution.
Buffalo General Electric Company,
Buffalo, N. Y.

Light-Weight Wooden Insulating Stand

PORTABLE insulating stands fill a variety of needs in a substation or power house. Such stands are frequently made by supporting a small platform on inverted insulators, but they are extremely heavy. A good stand should first of all possess the necessary insulating qualities. The next requisite is mechanical strength, and the third is to secure the first two without the sacrifice of easy portability. The stand should not

WOODEN INSULATING STAND WEIGHS ONLY 15½ LB.

be so heavy that one will be tempted to "take a chance" in preference to using the stand.

A stand that meets these requirements is shown in the accompanying illustration. It is made of wood that has been thoroughly dried. The legs and braces are of maple to which four coats of shellac have been applied, and the top is of white pine painted black. The stand is 19½ in. (50 cm.) high, the top is 15½ in. (38 cm.) square, and the legs form a base 14¾ in. (36 cm.) square. The stand weighs 15½ lb. (6.8 kg.) and has a flashover value of 210,000 volts when dry.

Prior to building this stand one was made by cementing a porcelain insulator on a casting that formed four supporting legs. Compared with this the wooden stand now being used has a 50 per cent higher flashover value, will stand more hard usage, weighs half as much and is cheaper to construct.

HARRY RESTOFSKI.
Connellsville, Pa.

Hints on Operating Power-Plant Switches

AN OPERATOR of a power plant should understand the switches and bus arrangement so that if any switch fails to operate he will know what to do. Knowledge of any past switch failure will prove helpful. The location of fuses in the control circuits should be known as well as the operation of the switch by hand. If the tripping element of a switch is out of order and if the switch must be left in service, some special operating procedure must be followed to isolate the trouble. The opening of bus selector, tie or transformer switches will be found convenient in some stations, while in others the generator switches would have to be opened unless a man were stationed near the switch to open it manually or by means of small rope. If the closing element of an alternating current generator switch is out of order although it can be closed by hand, temporary synchronizing lamps will permit synchronizing the generator. The lights should be near the switch.

Iron Mountain, Mich. I. W. WYSS.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Easy Method of Testing for Induction Motor Shorts

IN the Oct. 11, 1919, issue of the ELECTRICAL WORLD there appeared a description of a device used to locate short-circuited coils of an induction motor. Some time ago the writer had an occasion to test a large number of small induction motors and made use of a similar device, although slightly different in some respects. It was constructed similar to the one described, excepting that the "U" was flattened enough to span about six or eight slots, and the ends of the laminations were rounded, so that it could be used for different-size stators. In this instance it was used on motor sizes from ½ hp. to 20 hp. with good results.

If a thin piece of steel, such as a knife blade or a hack-saw blade, is placed on the stator slots with the "growler," energized, the steel will stick across a slot in which there is a shorted coil. With a little practice it is an easy matter to determine whether only one turn is shorted, as might be caused by the insulation being damaged where two wires cross in the slot, or whether the entire coil is short-circuited. In this way the faulty coil can be definitely located, as the steel will stick on both slots through which the coil passes. Thus it is not necessary to induce enough current in the coil to heat it, nor is any time wasted in waiting for it to heat.

L. C. BEATY.

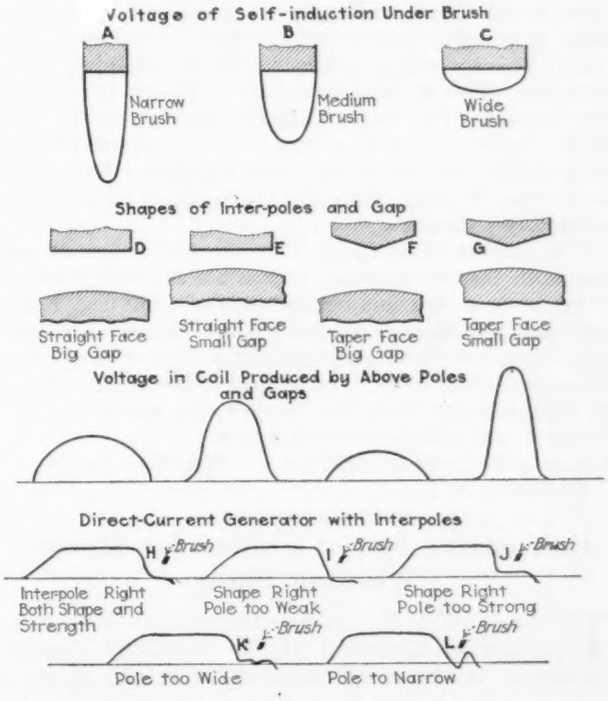
Pittsfield, Mass.

The Correct Shape and Strength of Interpoles

ALTHOUGH the selection of the correct strength and shape of interpoles should be made in the factory, it is not always possible to make complete tests under load, so that observation and adjustment may be necessary in the field. The main requirement for good operation is that the coil at the moment that its commutator bars leave the brush should be generating current in the direction opposite to that in which the current flowed just before the commutator bars reached the brush. Otherwise there would be a spark due to self-inductive kick at the instant the brush ceases to short-circuit the coil.

The voltage of self-induction under the brush is shown in *A*, *B* and *C* of the illustration. The interpole can be designed to overcome this voltage by making its strength a little greater than is necessary to overcome the armature reaction alone. A machine with narrow brushes needs a different interpole strength to counteract the self-induction than that which is needed by a machine with thick brushes. By shaping the interpole space and gap to suit conditions, satisfactory operation can be obtained. Interpole voltage waves can be actually observed unmixed with main voltage waves by operating the machine short-circuited. A few of the representative forms of interpole and gap voltage produced are shown at *D*, *E*, *F* and *G*.

If the machine has a self-induction effect like *A*, it needs an interpole like *G* to overcome it properly, and it is impossible to obtain good results with an interpole like *D* or *F* because they are not suitable. On the other hand, if a machine with wide brushes and self-induction curve, as *C*, has a straight-face interpole with big gap like *D* but a trifle stronger than needed to exactly counteract the self-induction, a result as shown at *H* will be obtained, which is correct. If the interpole is too weak, the curve is obtained like that in *I*. If too strong, it will be like *J*. Further, if a wide interpole *D* is used with self-induction curve like



EFFECT OF SHAPE AND STRENGTH OF BRUSH ON OPERATION

B, a voltage curve similar to *K* is obtained. However, if an interpole like *G* is used with a self-induction like *D*, then a voltage curve will be obtained like *L*.

In general, bumps and reversals in voltage near the brush show the interpole to be of the wrong shape.

Crocker Wheeler Company, JAMES DIXON.
Ampere, N. J.

Jewelers' Furnace Found Satisfactory

FOR the heat treatment of steel and fusing enamel at 1600 deg. F. (870 deg. C.) a small electric furnace installed in the factory of Bastian Brothers Company, Rochester, N. Y., has proved highly satisfactory. This company manufactures small jewelry and nameplates, a work which requires accurate temperature regulation. The furnace is compact and self-contained, the desired operating temperature being maintained by adjusting a rheostat and watching a pyrometer. No

auxiliary apparatus is required for control. The only permanent connections necessary are those which supply the energy to the furnace.

The furnace, which is of Hoskins manufacture, has a heating surface 12 in. wide by 8 in. high by 19 in. deep (30 cm. by 20 cm. by 48 cm.) and is well insulated by 2½ in. (6.3 cm.) of bonded "kieselguhr" covered with several inches of bonded asbestos and magnesia. It is supported on an iron stand 40 in. (1 m.) from the floor. The door, which is of the sliding type, counterbalanced, can be arranged so that it will stay set at any desired point. This counterbalance weight can be adjusted so that the door, when desired, can be closed automatically. The radiation loss of heat often caused by poorly insulated front heads of furnaces is reduced to a minimum by properly covering the door with asbestos. A shelf 6 in. (15 cm.) wide placed at the front head has been found to be of convenience in handling the finished work.

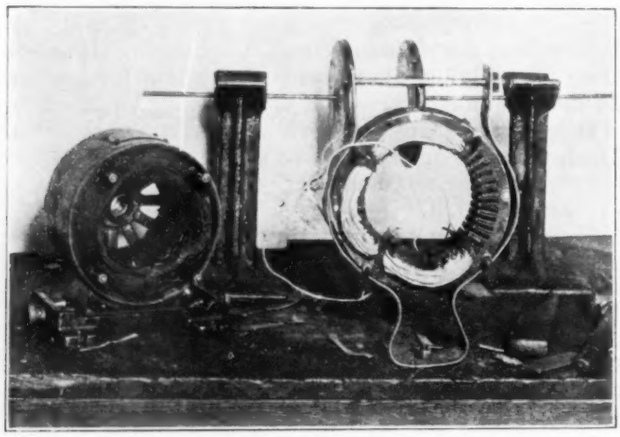
The heating element, an alloy of nickel and chromium, consists of three windings of nickel and chromium alloy in parallel with a total rating of 10 kw. at 230 volts. These windings are controlled by individual knife switches. Two of these are controlled from the side of the furnace. The third knife switch, also on the side of the furnace, acts as a shunt on the rheostat, which is in series with one of the three windings. The tubes or muffles of these windings are made of alundum, a refractory substance.

The bonded "kieselguhr," the bonded asbestos and magnesia insulation make it possible for this furnace to maintain a constant temperature of 1600 deg. Fahr. (870 deg. C.) at approximately 6 kw. imput. The furnace temperature as indicated by a Taylor pyrometer is controlled manually. On account of the small amount of heat radiated from the furnace the operator's discomforts are reduced to a minimum.

Rochester Railway & Light Co., FRANK C. TAYLOR.
Rochester, N. Y.

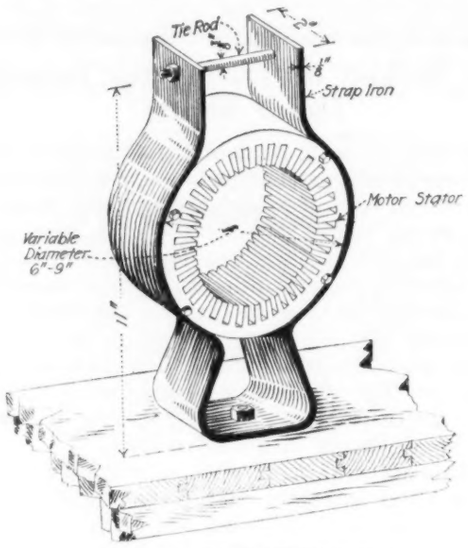
Convenient Stator Holder for Motor-Winding Shop

TO FACILITATE holding motor stators during rewinding at the shop of the American Electric Service & Maintenance Company, Springfield, Mass., a



STATOR IS HELD IN FRAME WHILE COILS ARE PUT IN PLACE

flexible metallic holder which consists of a piece of strap iron is used. The strap iron is about 28 in. (70 cm.) long, bent into the shape of a U-clamp, with the upper ends held in place by an adjustable rod and bolts. The lower end is bolted to the bench and the whole outfit forms a springy receptacle which can be adjusted to a wide variety of motor frames ranging in diameter from 6 in. to 9 in. (15 cm. to 25 cm.). The strap iron of



DETAILS OF STATOR HOLDER

which the holder is made is 2 in. wide and ⅛ in. thick (5 cm. by 3 mm.); the tie rod at the top is ⅜ in. (10 mm.) in diameter, and a ⅜-in. bolt fastens it to the bench. It stands about 11 in. (28 cm.) high.

Service Is Sectionalized at Stairway Landings

AT THE Hendee Manufacturing Company's plant in Springfield, Mass., the power service of various departments and floors is conveniently sectionalized by automatic oil circuit breakers installed in the stairway landings. A main cut-out box is also provided beside the breaker so that the control of power service is centralized. A group of departments can be isolated from the rest electrically and on account of the location of the circuit breakers can be restored to service with minimum loss of time. When repairs are necessary such an arrangement is of great convenience because it enables production to be resumed within a few seconds of the time when all is in readiness for the floor output.

Necessity for Reading Watt-Hour Meter Daily

THE necessity for reading the watt-hour meter daily was brought forcibly to the attention of an industrial plant in the Middle West recently when the energy bill for one month greatly exceeded previous ones. An investigation showed that a 150-kw., 440/660-volt, three-phase, 60-cycle motor-generator set had been operating as a single-phase machine. The motor of this set is of squirrel-cage type, and it is started by means of a standard compensator, there also being an oil switch and an ammeter in the incoming circuit. The ammeter has a total scale of zero to 800 amp. A watt-hour meter registers the energy used and is a basis of the monthly bill by the electric service company.

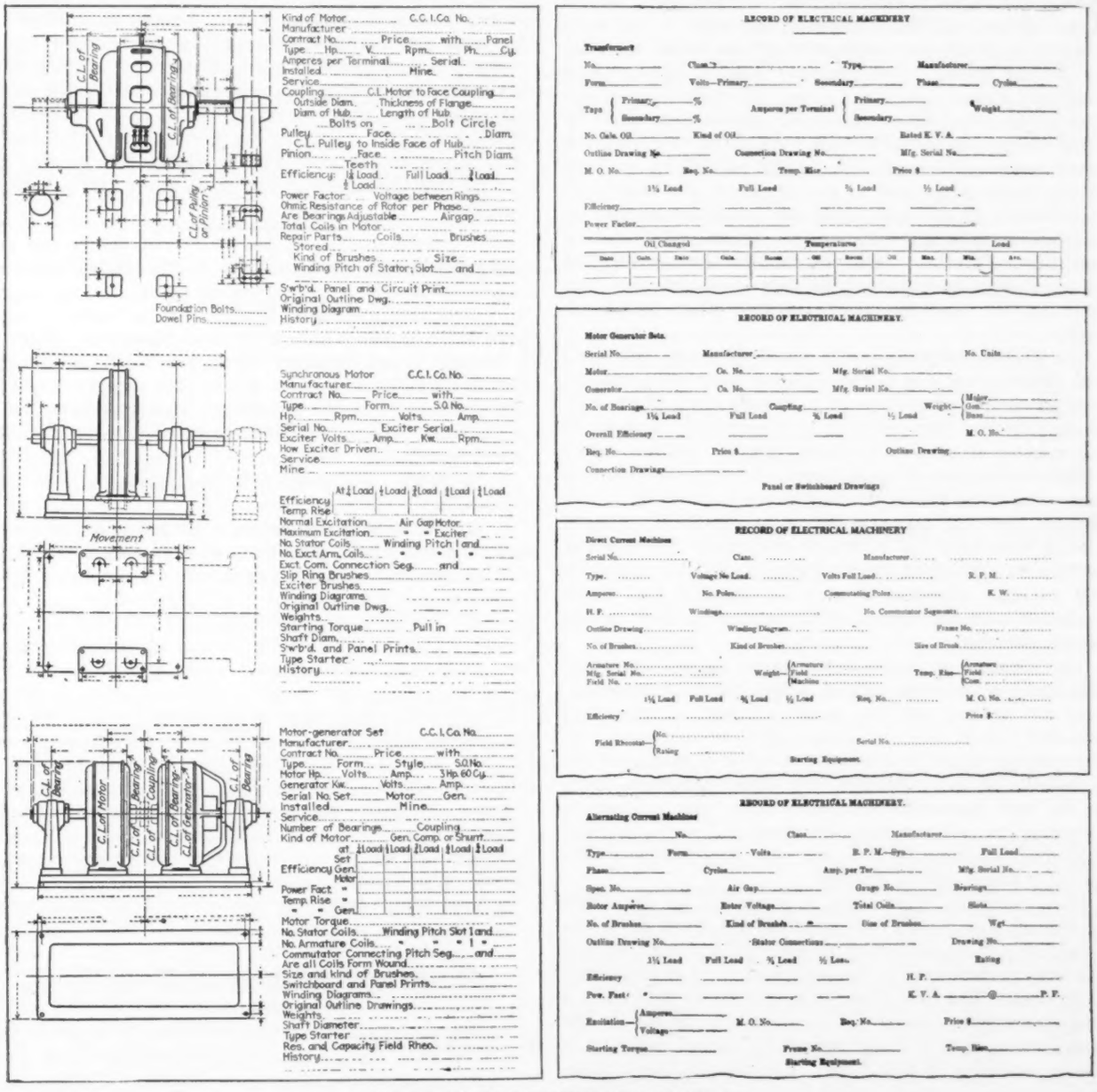
This set operates under light load most of the time, and it is required to stop and start frequently. A study of the situation showed that when this motor had been started at one time a fuse had been blown, but it passed unnoticed. When starting, the fuses are shunted so that the motor first operates on three-phase energy, but later when the short circuit is open it operates on single-phase.

As the load carried by this set was very light after starting, it was kept running at single-phase and did not overheat. But nevertheless more energy was being taken to operate this motor single-phase than would have been taken to operate it three-phase, which accounts for the increased bill.

The ammeter scale being very high, the zero to 200 first division did not allow an indication of the excess current on the ammeter. From this experience it was decided that meters should be read, if not once in twenty-four hours, then at least once a week in order to check any irregularities in the system.

Records That Facilitate Replacements and Repairs

PARTIAL records of electrical machinery have proved so useless when information is needed that many iron and copper mining companies of the upper Michigan peninsula are now making their office records of electrical apparatus complete, irrespective of the amount of paper that may be required to do it. Separate forms are made up for direct-current, induction and synchronous machinery, motor-generator sets, and for transformers. Sample of the records are shown in the illustration on this page.



SAMPLE RECORDS OF ELECTRICAL APPARATUS

These records may seem too extensive, but it should be remembered that they are compiled only once (when the apparatus is bought). Furthermore, it takes only a short time per machine then, and when the work of compiling them is well done the records have proved invaluable many times during the life of the apparatus they cover.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Motor-Driven Refrigerators Give Detroit No Trouble

INQUIRY into the motor-driven refrigerator situation at Detroit, Mich., showed that there is no complete record of the refrigerating machines installed in Detroit homes. One company manufacturing these machines stated that it had about 350 of them in operation in the city. The number of installations made by other companies is not known. All these refrigerating machines are equipped with 0.5-hp. to 0.25-hp. motors. So far there is no case on record where any change in distribution or in meter equipment could be charged up to the installation of one of these refrigerating machines. In other words, no installation has resulted in complaints of poor service from the customer who operates the machine or from any other customers nearby.

More specifically the performance of ninety machines was followed up, and in these ninety cases there was no need of change of equipment to handle the load created. In no case had the customer any complaint to make of the quality of service received, and in no case, after careful inspection of conditions in the distribution system, were these found unsatisfactory or in need of any change to bring the system up to standard. Special meters were installed on a few machines. The highest reading for any whole working month was approximately 150 kw.-hr. However it may be possible that these machines were not operating during the warmest period of last summer.

The increase of revenue caused by the refrigerating load has not yet been noticed in the general income figures on account of the small number of machines installed, but it is quite evident that an increased revenue should be felt as a greater number of machines are installed. So far, naturally, only those customers living in the best classes of residences have been induced to purchase the refrigerating machines, so that in all cases they are operating on a 4-cent rate because the customer is a large user of energy.

It is naturally interesting to speculate on the effect of a great number of refrigerating machines on a distribution system, and some investigation along this line has been undertaken by the central-station organization at Detroit. The first thing considered was that such a load is a summer load. This means that as far as the distribution system is concerned additional capacity is always available at that time. The distribution system in that period is usually going through a transition from being equipped for the preceding winter's peak load to a larger amount of equipment to handle the coming winter's peak load. However, with no increase over the equipment required to handle the preceding winter's peak load, in practically all cases, unless new buildings are going up very rapidly, there will be sufficient additional capacity to handle a refrigerating load and no special provision should have to be made. It seems, therefore, that as far as the distribution system is concerned the refrigerating load is ideal as it will require very little or no increase in equipment for its handling.

There is a possibility of some machines operating during the winter where ice boxes have no access to the outside air or where ice is wanted for use in drinking water. This should occur only in a small percentage of the total installations. Regarding the system as a whole, it is probable that some of the refrigerating load will superimpose itself on the peak load during the summer months and that this effect will be quite noticeable, although the load factor of the system should be somewhat improved. Interest is soon expected to develop in determining the diversity factor on these refrigerating machines.

Appliance Inspection Gets Business and Good Will

IN THE summer of 1919 the Houghton County Electric Light Company, Houghton, Mich., conducted what it called a service and convenience campaign which paid for itself and put many defective appliances back on the lines. The objects of the campaign were outlined as follows:

1. To repair and return to the lines all defective appliances.
2. To introduce and encourage the use of convenience outlets, current taps, feed-through cord switches, etc.
3. To compile a customers' appliance connected load report showing the number of the different makes and styles of appliances in use.
4. To take the opportunity to sell and acquaint customers with the merits of electric appliances in general.
5. To show that the company desired to give the best possible service with a minimum of inconvenience to customers.

Name _____ Prospect for

Street _____

City _____

APPLIANCES	MAKE	IN GOOD CONDITION	REPAIRS MADE	SOLD	CASH	CHARGE
Iron						
Washer						
Vacuum						
Toaster						
Grill						
Percolator						
Heating Pad						
Curling Iron						
Saw Motor						
Hotplate						
Range						

The above Appliances were repaired to my entire satisfaction.

ONE OF THE CARDS USED ON SERVICE AND CONVENIENCE CAMPAIGN

The information was then summarized each day for a week and then placed on cards.

Before making the campaign general the plan was tried out in a representative section of one of the towns supplied by the company. Boys were first trained for the work, but they did not prove so reliable or satis-

factory as girls. One girl called on 618 customers and inspected 778 appliances in the forty-eight days of the trial period. One hundred and sixty-five customers, or 26.6 per cent of the total, had appliances which were not being used on account of burned-out heating elements, damaged plugs, defective cords, etc. A saturation chart was compiled from the inspector's cards showing the percentage of customers who had each of the different appliances. These figures were as follows:

	Per Cent		Per Cent
Irons	88	Heating pads	0.6
Washing Machines	10	Curling irons	1
Toasters	18	Sewing-machine motors	0.3
Vacuum cleaners	9	Hot plates	0.1
Grills	3	Electric range	
Percolators	4		

The added energy consumption of the appliances which were put back into service was said to be well worth the cost of the campaign, but the records show that the net profits from the sale of appliances by the inspectors was more than enough to pay the entire cost to the company. This was based on results from a typical section of Houghton, Mich., but since the company has extended the campaign to all its properties equally advantageous results have been obtained.

Each inspector carried a fiber case about 12 in. long, 18 in. wide and 6 in. deep (30 mm. by 45 mm. by 15 mm.). This case contained the tools required to make repairs to appliances, a supply of heating elements, terminal plugs, separable attachment plugs, several lengths of cord, tape, thread, terminal post screws, nuts, bolts, a current tap, two-way and three-way cluster plugs, a three-way switch and a duplex baseboard outlet. The cases were refilled every morning and at noon.

The inspector offered to notify contractors if there was defective any wiring to be repaired or new work to be done. A record of each call was made on one of the cards shown in the illustration and a weekly summary was made on the other. Any complaints of excessive bills, errors in bills or requests for meter tests were written on the reverse side of the customer's report card before it was turned in to the office at night. Such complaints were followed up by the proper department, but in case of anything requiring immediate attention the inspector telephoned the complaint to the head office and it was handled as a trouble call. Advertisements in the local papers notified customers when the inspectors would be in their district. The whole plan was conceived and carried out under the direction of R. A. Gordon, sales manager of the Houghton (Mich.) County company.

Monthly Message to Customers

To maintain friendly relations with its customers and at the same time to push the use of electrical appliances, the Cambridge (Mass.) Electric Light Company publishes each month a little fourteen-page magazine called "The Electric Maid," designed to interest women in labor-saving conveniences for the home. Anecdotes and sketches fill part of the book. However, the two middle pages of a recent issue feature the following "spread:" "Introducing six little servants for your home (their acquaintance is inevitable), the Misses Clothes Washer, Clothes Ironer, Dish Washer, Sewing Machine, Vacuum Cleaner, Electric Range. They come to you overburdened with recommendations for consecutive years of faithful and efficient service. A dollar a week, for the six, satisfies their every need."

Keeping Up the Power Supply in Columbus, Ohio

Keeping Industry Alive

During the coal shortage, the great power stations of The Columbus Railway, Power and Light Co., always **at your service,** were generating electric power to keep industry alive. This was possible only because a great reserve of coal had been stored for just such a time.

The responsibility of keeping more than 90% of our local industries running caused the management to store in reserve enough coal to operate all of the plants in Columbus for three months.

Today the crisis has passed, but many cities are still crippled from scarcity of coal. Our industries, however, may go ahead in safety, for the coal pile will be replenished before it is exhausted.

Use More Electric Service

For convenience, dependability and low cost, electric service stands first. Rely on electricity for your power needs.

Somewhere in your plant there is a place for more electric service. Use more electricity.

Electric Power Is Clean, Convenient, and Trustworthy

"Not a Man Lost an Hour"

When other cities were slowing down or were entirely out of fuel, Columbus industries lost no time. As one factory manager said, "Not a man lost an hour." This is true of all plants and factories supplied by The Columbus Railway, Power and Light Company. In the face of the situation as it resulted in other cities this is indeed remarkable.

The Reserve Coal Pile

Months ago when the coal strike was only a possibility, the management of the Columbus Railway, Power and Light Co. began to store coal. Realizing the responsibility of the company to the industries of Columbus, the size of the coal pile was increased until a three months' supply was on hand. The reserve coal pile saved Columbus from loss and kept our factories at work.

The Columbus Railway, Power and Light Company

General Offices: 102-104 North Third Street

The record of the Columbus (Ohio) Railway, Power & Light Company during the recent coal strike was so favorable that after the crisis was over it advertised its success in maintaining power supply.

Utility Establishes Free Market for Its Stock

TO PROTECT its stockholders from those not in accord with the company's policy of selling its stock direct to customers instead of through bond houses, the Union Electric Light & Power Company has established a permanent securities department through which any shareholder's stock may be offered for resale without charge. It is the purpose of the company to maintain an open market in which shareholders may be reasonably sure of being able to get the full market value for their holdings at any time. With this end in view the company has eliminated the slight amount which had heretofore been charged for reselling stock.

The St. Louis company is obtaining from its customers a substantial portion of the money required to finance its very rapidly growing business. A block of $2,000,000 of 7 per cent preferred stock was sold at par during 1917, and another $1,000,000 block of the same stock is now being disposed of. The company reserves the right to redeem the stock at $105 per share at any time.

The stock issue is advertised in the daily press, but the actual sales are made over the counter at the com-

pany's offices and by the company's sales force, which includes three outside security salesmen. The price per share is $100 cash or $102 on a deferred payment plan under which the purchaser pays $10.20 with the order and the same amount with the nine succeeding bills for electric service. The installment payments draw 5 per cent interest, and they may be withdrawn with interest at any time before the final payment is made.

The first $2,000,000 was sold to about 2,600 of the company's 110,000 customers, and forty-five days after the third $1,000,000 was offered for sale 835 customers had taken $350,000. The offers to resell stock without charge to allow installments to be withdrawn inspire confidence in prospective buyers, but they are rarely accepted.

The shares brought in for resale have been disposed of at par without the loss of a cent to the investor, whereas brokers resold the stock at less than par and they charged commission besides. Some brokers also make a practice of taking the utility's securities at par in exchange for other securities which cost them about 80 or 85. The brokers could then sell the Union company's securities taken in exchange at 95 and still make 10 or 15 points on the deal. In spite of this competition the Union company has been able to sell its stock at a cost of about 2½ points.

Analysis of Engineering Employed in Power Sales

Handy and Sufficiently Accurate Method of Estimating Load Factor and Energy Consumption of Small Factories

BY A. G. DRURY

THE proposition which the central station has to offer to a prospective power consumer who is generating his own electricity from a steam or gas engine can be put into one of three classes.

First, where the central station has the overwhelming advantage. This is instanced where the power company operates a hydro-electric plant and it is only a matter of inducing the consumer to use the central station's energy instead of a competitor's, if one exists, or where, as often happens at the present time, a manufacturer needs additional power in a hurry. There seems to be a general impression among manufacturers that if a wire is running past a plant (even though it be an arc circuit) all the electric company has to do to give the manufacturer service is to run the wire into the plant. This the manufacturer thinks the electric company would do as a matter of course if it were only half so progressive in its business as he is in his.

Now, pole lines cannot be built in a day nor existing lines reinforced in an afternoon, and this has to be explained, sometimes to very skeptical listeners. In either case it is a matter of pure salesmanship and no engineering work is required of a solicitor—which is, of course, the ideal condition.

The other extreme is where the central station is going after a rather large installation and the question of cost runs pretty close. Then a considerable amount of engineering is done—complete engine tests, weighing the coal burned, laying out proposed motor drives, finally ending up by curves of voltage regulation showing the the plant—usually operated on direct current—is responsive to voltage fluctuations, and how, when this voltage drops, every machine in the factory slows up.

The third case is that of the smaller isolated plant, say of 25 hp. to 50 hp. Here the solicitor is morally sure his proposition is the better. It would not pay, nor would it even be wise, to go into extensive research on such a plant. The manufacturer is usually afraid of the cost, and it is up to the salesman to give an estimate in which he as well as the customer can have some confidence.

The following plan has been used by the writer with satisfactory results both as to fair accuracy in estimating bills and in the psychological effect on the prospect. He has found that the data given in the "Electrical Salesman's Handbook" and the publications of the large electrical manufacturers on the amount of power required to run any individual machine are satisfactory if used intelligently. On the other hand, he has never been satisfied to use the published average load factors.

To assume, for instance, that the load factor of a certain woodworking shop is so many per cent simply because the plant is a woodworking establishment is nonsense. It is common knowledge that a plant may easily vary 60 per cent from the general average. However, the data published on the power required to operate the individual machine, used with a load factor based on observation of the particular plant in question, make a rational basis for estimating on the comparative cost of central-station and isolated-plant drive.

The plan pursued in obtaining data on the load factor was as follows:

Down the left vertical edge on the heavy horizontal lines of a piece of standard cross-section paper, twenty squares to the inch, are listed all the machines in the room of the factory. Along the bottom horizontal line is recorded the time of day, using one small square to record one minute. Seated in a convenient place in the shop, the observer begins to draw a horizontal line opposite the name of a machine and over the corresponding time when it was started up. While sitting there he continues to go over the list of machines from top to bottom, extending the lines if the machine is still running and stopping the line when the machine stopped.

If these data are taken for an hour at a time on each of three or four different days at different times, the investigator will have a pretty fair idea of what the plant is doing. The average of the percentage of the time that each individual machine is running while the investigator is present, multiplied by the working hours per month, gives a fair average of the hours that machine runs per month. This product, multiplied by the power required to drive the machine, as given in the tables, represents the number of kilowatt-hours it would consume in a month.

Take a simple example. Suppose the plant was visited four times for one hour each time. During that hour each day a planer drawing 10 hp. (by the handbook table) ran fifteen minutes, that is 25 per cent of the time; a jointer of 3 hp., thirty minutes, or 50 per cent of the time, a tenoner of 1 hp., ten minutes, or 16 per cent of the time. Now if the times were well selected, this can be assumed as an average operation.

	Hp.
Average power consumed by planer, 25 times 10 hp....	2.5
Average power consumed by joiner, 50 times 3 hp.....	1.6
Average power consumed by tenoner, 16 times 1 hp....	.16
Average total	4.16

Then 4.16 hp. times 240 working hours per month equals 998 hp.-hr., or nearly 750 kw.hr. per month.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Direct Method of Calculating Shunt-Field Coils Having Two Gages of Wire.—R. G. JAKEMAN.—In the design of shunt-field coils it often happens that the area of wire required is not included in standard wire tables, and then the two nearest standard gages above and below have to be used. It is necessary therefore to find out how much of each gage of wire has to be used to obtain the desired result. Experienced engineers can sometimes arrive at the correct results quickly by a trial method, but less experienced men often try four or five times, which makes the work tedious. In this article the author offers equations and curves for rapid solution of the problems.—London *Electrician*, Nov. 21, 1919.

Lamps and Lighting

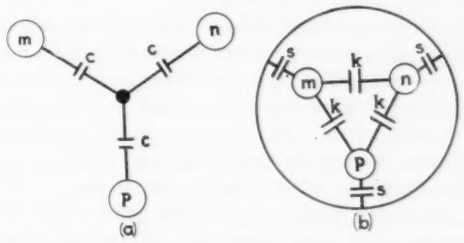
Automobile Headlighting Specifications.—In collaboration with the authorities in New York State the committee on automobile headlighting of the Illuminating Engineering Society has tentatively adopted for future use in connection with a model headlight law, a somewhat strengthened set of specifications for acceptability tests of headlights compared with those submitted within the last year or two. The gist of the new propositions is contained in the following set of test positions and candlepower limitations: (1) Some point between road level and a point on a level with the lamps in the axis of the car, 4,800 cp.; (2) in the axis of the car 60 in. (1.5 m.) above the roadway at 100 ft., 2,400 cp.; (3) 60 in. above the roadway, 7 ft. (2.1 m.) to the left of the axis of the car at 100 ft., 800 cp.; (4) at 100 ft. (30 m.) at some point between road level and a point on a level with the lamps and 7 ft. to the right of the axis of the car, 1,200 cp.—Convention Illuminating Engineering Society, Oct. 20, 1919.

Military Searchlamps of Large Caliber.—M. GROSJEAN.—Comparative descriptions are given of the various types of motor-regulated arc lamps and parabolic mirrors used for electric searchlamps in France during the war. The method of testing mirrors is described, and photographs are presented which show the results of tests on mirrors of glass and gold-plated metal, made by the Société Sautter-Harlé, the latter type being used almost exclusively during the later years of the war. Extensive numerical data regarding different kinds of carbons are given. In one of the recent lamps with 200 mm. ($7\frac{7}{8}$ in.) mirror diameter, built for 300 amp. and 90 volts, positive carbons of 3 cm. ($1\frac{3}{16}$ in.) diameter were employed, which had a strongly metallized core and were electrolytically copper-plated. The brilliancy obtained was from 250 cp. to 500 cp. per sq.mm., and the positive carbon was used up at the rate of 150 mm. (6 in.) an hour, the rate of combustion on the negative carbon, which was plated with copper and nickel, being about half as much. — *Revue Générale d'Electricité*, Oct. 4, 1919.

An Autogenerative Flash Lamp.—An electric flashlamp is described which does not contain any batteries but derives its current from a small six-pole permanent magnet generator, driven by ratchet and gears from a handle actuated by hand. A similar device is suggested for electric ignition of explosives.—*L'Industrie Electrique*, Oct. 10, 1919.

Generation, Transmission and Distribution

Capacity of Lead-Sheathed Three-Phase Cables.—R. BOUZON.—The author indicates a method by which the "star capacity" of a three-phase cable may be determined by a single measurement. Thence may be determined the capacitance current in the cable on open circuit. In the illustration (a) shows three conductors arranged at the corners of a triangle and (b) represents the case of a sheathed three-phase cable. This amounts to a system of three condensers k in delta, operating in parallel with three condensers s connected in star to the neutral (the lead sheath.) Measuring by ballistic galvanometer the capacity c' of m with regard to n, we have $c' = 3/2\ (k + s/3)$. Similarly, the capacity of m with regard to n and p connected together



CAPACITANCE OF A THREE-CONDUCTOR CABLE

is $c'' = 2\ (k + s/3)$. This complex arrangement of condensers may be replaced by an equivalent star arrangement (a), in which $c = 2c' = 3/2c''$. In other words, the star-capacity c, permitting calculation of the capacitance current in a three-phase lead-sheathed cable, is twice the capacity measured between two conductors, the third being insulated, or 3/2 times the capacity measured between one conductor and the other two connected together. Knowing the equivalent star capacity c, the capacitance current $I = \omega c\ E/\sqrt{3} = \omega c e$, where e is the neutral voltage. Sometimes coefficients are used to determine c in terms of the capacity between one conductor and the two other connected to the lead sheath; this, however, involves two measurements to determine k and s separately. The author's method is the only one giving mathematically accurate results from a single measurement.—*Science Abstracts, Section B*, July 31, 1919. (Abstracted from *Rev. Gen. d'Elec.*, May 3, 1919.)

Automatic and Remote Control Generating Stations.—A. G. DARLING.—The author points to the successful automatic operations of substations and also two instances of attendantless operation of generating plants. It is suggested that many water-power developments which could not be economically operated on account of high labor costs may now be carried out and operated by remote control or automatic equipment. He discusses various means whereby the automatic generating

station may be controlled, depending upon the conditions surrounding the installation and the object to be accomplished.—*General Electric Review,* November, 1919.

Fictitious Capacities in Polyphase Cables.—DELLA RICCIA.—The general Maxwell equations, giving charges in terms of the voltages and of the induction coefficients, lead to simple relations in the case of symmetrical polyphase cables. They permit the determination of these coefficients from the measured capacity of certain combinations, as, for instance, between one conductor and all the others. It has been shown that with balanced polyphased voltages impressed the charges on the conductors may be expressed in terms of fictitious capacities and the respective star voltages. The author extends this reasoning to cases where successive phases are not connected to successive conductors in the cable and gives expressions for the fictitious capacity in terms of the induction coefficients. This analysis permits a discussion of the effects of harmonics. If the specific inductivity of the dielectric depends on the voltage, the fictitious capacity cannot be treated as a constant, but will contain a periodic term of double supply frequency, and the charging current will contain a third harmonic. If the medium is dissipative, the periodic capacity term will appear displaced. Diagrams are given showing current distortion and power dissipation.—*Revue Générale d'Electricité,* Sept. 20, 1919.

Discontinuities in Overhead Transmissions.—Rushes of voltage are liable to occur when a surge of external or internal origin reaches a discontinuity in a transmission line. A discontinuity exists at points where the surge resistance of the line per unit length changes, for instance, where an overhead and underground line meet, the diameter of the conductor changes, the height of the conductor varies, or where conductors of different circuits that have been run along the same route branch off in different directions. Calculations are made of the variation of the surge resistance for changes in the quantities mentioned. The earthing of the lines is a matter of great difficulty in rocky regions, and in such places the height of the line above the earth must be measured, not to the rocky surface, but to the actual position of damp earth. In the Isonzo transmission line some of the numerous breakdowns were probably due to sudden changes of line characteristics at places where the earth dips down suddenly under large superimposed rock masses, thus producing a sudden change in the effective height of the line above the earth.—*Technical Review,* Oct. 14. (Abstracted from *Elektrotechnik und Maschinenbau,* June 29, 1919.)

Traction

Automatic Control for Boston Surface Cars.—A. D. WEBSTER.—This installation by the Boston Elevated Railway Company is notable in providing for the multiple-unit operation of city cars where private right-of-way is employed in the more congested district. The equipment complies with the recognized essentials of safety, convenience and speed. Besides the provision of efficient car appliances and a thoroughly worked-out scheme of auxiliaries operated from an independent low-voltage control source, the car is equipped with a fully protected automatic motor control.—*Electric Journal,* October, 1919.

The Safety Car.—N. H. CALLARD, JR.—The author points out the increasing use of safety or one-man cars and considers in particular safety features, operating costs and the car mileage obtainable with this type of electric railway car.—*Electric Journal,* October, 1919.

Overloads in Railway Motors.—F. W. MCCLOSKEY.—In addition to handling the normal traffic, railway motors are occasionally called upon to perform emergency service such as pulling in a "dead car." It is important that the motors be capable of performing such emergency service in order to prevent traffic tie-ups, even at the expense of damage to the motor itself, provided that the motor is not put out of service. The author points out that the work of "bucking" snow is particularly severe and advocates the use of snow plows equipped with heavy motors for this service.—*Electric Journal,* October, 1919.

The Electrification of the South African Railways.—A very comprehensive report of the desirability of electrification of certain sections of the South African railways has been prepared by Messrs. Merz and McLellan. They recommend that the working voltage be 3000, direct current, which would enable the substations to be spaced from 20 miles to 30 miles (32 km. to 48 km.) apart. The third-rail scheme was considered impracticable for South Africa, due to the danger of people straying on the track. The multiple unit system is recommended wherever this is possible on suburban lines. It is pointed out that this service would create the traffic if properly planned. An interesting suggestion for overcoming the possible shortage of water at any point is that of erecting small power stations containing one generating set at various points along the line and linking them by a high-tension transmission line, thus distributing the spare plant over the whole system.—London *Electrician,* Nov. 7, 1919.

Installations, Systems and Appliances

Improvements in Contactor Types of Industrial Controllers.—H. D. JAMES.—The writer considers means of suppressing quickly and definitely the arcs developed in contactor breaks which are apt to weld together the contacts. He states that the rolling contact is considered preferable at the present time. The correct design of magnetic blow-out is considered and also the proper insulation of the operating coil which has been improved by the use of better material and better processes.—*Electric Journal,* November, 1919.

High-Temperature Electric Resistance Furnace.—WALTER ROSENHAIN and E. A. COAD-PRYOR.—The underlying principle on which the construction of this furnace is based is the utilization not of the ohmic resistance of the graphite but of the resistance which exists wherever graphite surfaces are placed in contact. It is believed that the type of furnace, although still relying upon carbon or graphite for the material of the resistor, overcomes all the disadvantages encountered when graphite resistance is used, except that it does not entirely eliminate the necessity of keeping the resistor in a neutral atmosphere. The latter difficulty can, however, be overcome to a sufficient extent for many purposes.—*Transactions Faraday Society,* July, 1919.

A Current-Limiting Regulator for Alternating-Current Circuits.—The question of protecting a circuit against excessive overload, without at the same time making the device employed so delicate in operation that it is always coming to action, is an important one in connection with industrial loads. One solution of the

problem is suggested in a current-limiting regulator. This has been arranged in the form of a transformer. The primary can be wound for any voltage, the secondary being wound to give the required working volts. Current can be taken from the secondary up to any predetermined amount within the capacity of the winding, and when this predetermined amount is reached the current remains constant and the volts decrease gradually to zero at short circuit. The device may be designed as a choke coil and in this form is connected in series with the work. In this position, when operating normally, it does not introduce any appreciable choke or resistance into the circuit, but after the current reaches a predetermined value the leakage flux increases and keeps the current constant at that value until the load becomes a complete short circuit.—London *Electrician*, Nov. 7, 1919.

The Future of the Electrical Equipment of Small Reversing Mills.—L. ROTHERA.—The writer points out the fact that higher speeds of rolling may be obtained by the use of motor drive and that, with an increasing necessity for large outputs and a reduction in operating costs, the future would see a wide extension of the electrical reversing drive for small mills. Extensive tables give the electrically driven rolling mills equipped by British firms and considerable detail regarding the type of mill, the motor and the drive adopted.—London *Electrician*, Sept. 26, 1919.

Electrophysics and Magnetism

Photoelectric Spectrophotometry by the Null Method.—K. S. GIBSON.—Reliable determinations of spectral transmission throughout the green, blue and violet have been made by means of the photoelectric null method described in this paper. All errors have been eliminated as well as the necessity of any tests, calibrations or corrections in connection with the current-irradiation law or the dark currents of the photoelectric cells, or with electrometer deflection methods. Measurements can be made from 380 to 650 millimicrons, the best range being from 410 to 550. Measurements of spectral diffuse reflection relative to that of magnesium carbonate have also been made.—*U. S. Bureau of Standards, Scientific Paper No. 349*, Oct. 11, 1919.

Electrochemistry and Batteries

Power Systems of the North Central States.—CHESTER H. JONES.—The writer points out the fact that hydroelectric systems and large steam plants in the States of Wisconsin, Illinois, Michigan and Indiana offer considerable prospects for electrochemical and chemical industrial developments. The extension of transmission lines in these states also opens way for development of natural resources. Excellent maps showing electrical lines accompany the article.—*Chemical and Metallurgical Engineering*, Sept. 15, 1919.

Tests on a New Insulating Material.—The Schnetzer insulating material for electric conductors has proved most resistant to atmospheric influences and to chemical fumes. In a stearine factory where rubber insulation was usually destroyed in four to five months it has been in use two to three years and is still in good condition. It has been used in wet situations, with good results, and resists acid better than lead coating. The material is coated with a special varnish, the composition of which is kept secret.—*Technical Review*, Oct. 28. (Abstracted from *Zeitschrift des Oesterr. Ingenieur und Architekten Vereines*, Sept. 5, 1919.)

Effect of Amalgamation Upon the Single Potentials of Certain Binary Alloys.—LOUIS KAHLENBERG and JOHN A. MONTGOMERY.—The writers studied the effect of amalgamation upon alloys of aluminum with copper, zinc and nickel.—*Proceedings American Electrochemical Society*, Sept. 23, 1919.

Telegraphy, Telephony and Signals

Variation in Direction of Propagation of Long Electromagnetic Waves.—A. HOYT TAYLOR.—The observed direction of radio waves as obtained with a direction finder varies with time when long waves are used such as those from very high power stations. The variations of direction are of the order of 90 deg. for very long waves. No such large variations are found for short damped waves produced by spark apparatus. A method of increasing the sharpness of determination of direction has been worked out. A theoretical explanation of the variations of direction is given, based on the existence of media in the earth's atmosphere capable of reflecting and refracting the waves.—*U. S. Bureau of Standards*, Nov. 29, 1919.

Radio-Telephony.—E. H. COLPITTS.—The writer gives a brief summary of the historical developments of radio communication and then passes on to a description of the apparatus as developed at the present time.—*Journal of Society of Automotive Engineers*, September, 1919.

Radio Stations of the United States.—This pamphlet gives a list of the radio stations of the United States with the call systems and wave lengths in use in each case.—*Department of Commerce, Bureau of Navigation*, June 15, 1919.

Design of Poulsen Arc Converters for Radio-Telegraphy.—LEONARD F. FULLER.—The Poulsen arc-converter cycle is studied in detail, and the various relations between direct and alternating arc currents and voltages are obtained and discussed. The possible production of harmonics is considered. The effect of arc field strength on the arc phenomena is then taken up. The efficiency of the Poulsen arc cycle is obtained and checked experimentally. The theoretical relation between best field strength and wave length, arc current and voltage, and the nature of atmosphere surrounding the arc, is deduced and shown to be correct by elaborate experimental data. In this connection ethyl alcohol and kerosene atmospheres are compared. The design of the magnetic circuit is then handled in detail. The most economical pole shape is given, the tip being a triple-tapered conical frustrum. The tip-gap ratio and the pole-gap ratio are also experimentally obtained. Open and closed magnetic circuits are compared. The design of these large electromagnets is facilitated by the use of small models, the results thus obtained being reliable. Data are given for desirable chamber surface for various arc inputs and for the design of arc electrodes.—*Proceedings Institute of Radio Engineers*, October, 1919.

Direction Finding by Wireless Telegraphy.—RIALL SANKEY.—In this article are described and illustrated various stages of the direction-finding equipment used by the British.—London *Engineer*, Oct. 17, 1919.

Aircraft Telephony.—CAPT. B. S. COHEN.—The writer considers especially telephone apparatus designed for the use of kite balloons, airships and heavier-than-air craft where wire connections are possible.—London *Electrician*, Nov. 14, 1919.

CONTINUED heavy demands for power, high level of operating costs and stringent money rates point to a situation in 1920 that will call for co-operative action by central stations and the public service commissions. Ample supplies of power are urgently needed to meet the tremendous industrial requirements of the country. Costs of labor and materials entering into central-station expansion and operation do not recede, and the tendency is rather upward than downward. And money continues high, as is shown by the recent offering of Philadelphia Electric Company notes on a 7¼ interest basis, indicating that the net cost of the capital was even higher than this. Where the remedy is higher rates, companies will undoubtedly take the matter up promptly with the regulating commission.

The 25,000/66,000 volt tie line between the Edison Electric Illuminating Company, Boston, and the New England Power Company was put in service on Jan. 19, establishing interconnection of about 500,000 kw. capacity.

Informal conferences are under way between power company representatives and the California Railroad Commission to discuss the serious shortage of power due to continued drought. Curtailment in the agricultural load must take place in two weeks unless rain comes. Oregon also reports the driest January on record.

No temporary successor will be appointed to the late Dr. Richard C. MacLaurin, president Massachusetts Institute of Technology. An administrative committee of the faculty will govern the institution.

Rates for the Cleveland Electric Illuminating Company have been announced by the Ohio Public Utilities Commission.

Delegates of the American Institute of Electrical Engineers to the International Electrochemical Commission meeting in London last October have made a report to the Institute.

The Conference Club met at the Hotel Biltmore, New York, on Jan. 29, 30 and 31 to lay down a broad program for its future activities.

The movement for further standardizing control equipment and specifications for control apparatus will be given impetus at a meeting of the control apparatus section of the Electric Power Club at Chicago Feb. 6.

Bituminous coal production, according to the Geological Survey, has improved, but distribution is unsatisfactory.

According to Director Smith of the Geological Survey, this country is third in the world in potential water-power resources, but first in rank as determined by developed power.

Appointments of new officers for the Portland (Ore.) Railway, Light & Power Company include F. I. Fuller as first vice-president, in charge of railway operation, and O. B. Coldwell as second vice-president, in charge of electric light and power.

News in Brief

SUMMARY

of Important Happenings in the Industry During the Week

President Alex Dow of the Detroit Edison Company sees a busy year ahead and need for higher rates if operating conditions are not more favorable.

A report of the Geological Survey on power production in July, 1919, shows that in about 3,000 public service plants 39 per cent of the power was obtained from water.

B. G. Lamme, chief engineer of the Westinghouse Electric & Manufacturing Company, told the technical story of the synchronous converter to the St. Louis Section of the American Institute of Electrical Engineers on the evening of Jan. 28.

To enable the San Joaquin Light & Power Corporation to finance plant extensions and improvements, the California Railroad Commission has authorized it to issue $3,500,000 of 7 per cent preferred stock. This company plans to spend this year $2,500,000 on the new Kings River power project.

The Northern California Power Company, whose properties were recently purchased by the Pacific Gas & Electric Company, has been authorized by the Railroad Commission to issue $443,000 refunding and consolidating 5 per cent gold bonds. The Nevada California Power Company plans to spend during 1920 about $400,000 in development work on Leevining Creek, in Mono County, preparatory to the construction of additional plants to generate 15,000 hp.

In a report to the City Council of Seattle, Wash., Superintendent of Light J. D. Ross asks for $1,750,000 for completion of the Cedar Falls power plant to a capacity of 18,000 kw. He estimates the total cost of the Cedar Falls plant at $3,500,946.

President Ballard of the N. E. L. A. has reached New York.

The Pacific Coast convention of the American Institute of Electrical Engineers will be held in the Multnomah Hotel, Portland, Ore., on July 21 to 23.

At the fifteenth annual meeting of the Western Association of Electrical Inspectors in St. Louis this week steps were taken toward effecting a reduction in the cost of wiring.

F. G. R. Gordon addressed the New England Section of the N. E. L. A. on the dangers of Bolshevism.

Director Smith of the Geological Survey says that reasonable coal storage by central stations will help to abate seasonable demand for coal.

No let-up is evident in the jobbing field except in the Far West. There a decrease in shipbuilding, and a slowing down in the lumber industry has its effect on the jobbing market. Otherwise it is a buyers' market, the difficulty being to secure sufficient material to meet the orders. Wiring materials, except wire, are without doubt extremely short as for actual needs, to say nothing of being short as far as amounts for stocks are concerned. No quick relief is in sight for supplies of rigid conduit, outlet boxes, flexible armored conductor and the flexible conduits. The porcelains are short. Manufacturers are months behind on deliveries of virtually all materials, and transportation difficulties are further complicating the situation.

Price changes have been few this week. Merchant pipe went up, and it is not known on what card any future deliveries of rigid conduit will be based. Certain reflectors are up, washing machines are reported $50 higher and lamp cord and magnet wire have advanced again. With varying prices of cotton and labor, wire base prices are coming to mean less and less and some companies are quoting list prices based on actual costs.

Pacific Coast jobbers report considerable activity in the export of electrical appliances to the Orient, especially China and Japan.

A hydro-electric plant near Rimini to generate power for the streeet-lighting system of Helena, Mont., is being considered by the City Council.

Plans are being prepared for the erection of a new power plant for the United Illuminating Company on Congress Street, Bridgeport, Conn., to cost about $1,500,000.

New developments contemplated by the Western States Gas & Electric Company on the south fork of the American River, a few miles above the company's present hydro-electric development, include the construction of a reservoir for impounding waters in the Twin Lakes, Echo and Medley Lakes. A 1,900-ft. fall of water will be utilized, and it is expected that 30,000 hp. will be developed.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

President Ballard of the N.E.L.A. in New York

PRESIDENT R. H. BALLARD of the National Electric Light Association reached New York on Jan. 24. He was accompanied on the last stage of his journey from the Pacific Coast by M. H. Aylesworth, executive assistant to the president; Frank W. Smith, vice-president of the association, and Clarence L. Law, chairman of the lighting sales bureau.

During the present week Mr. Ballard has been engaged in meetings and business at national headquarters. Meetings of the public policy and executive committees were held as well as conferences with the vice-presidents and heads of the national sections and the headquarters staff.

George W. Elliott has taken active charge as master of transportation of the transportation arrangements for the 1920 Pasadena convention. President Ballard states that he expects an attendance of at least 4,000.

The following N. E. L. A. committee meetings were scheduled for the current week or for February:

Jan. 26—Executive committee meeting, Accounting Section, Hotel Statler, Detroit.

Jan. 27—Commercial aspects of lamp equipment division, lighting sales bureau, Commercial Section, New York.

Jan. 28—Executive conference, headquarters, New York.

Jan. 29—Executive committee, Electric Vehicle Section, headquarters, New York. Company sections special committee, headquarters, New York. Public policy committee, New York. Membership committee, New York.

Jan. 30—Executive committee, national association, New York.

Feb. 3—Meter committee, Technical and Hydro-Electric Section, Cleveland.

Feb. 16—Electrical apparatus committee, Technical and Hydro-Electric Section, headquarters, New York. Committee on inductive interference, Technical and Hydro-Electric Section, headquarters, New York. Committee on overhead systems, Technical and Hydro-Electric Section, headquarters, New York. Committee on prime movers, Technical and Hydro-Electric Section, headquarters, New York. Committee on underground systems, Technical and Hydro-Electric Section, headquarters, New York.

Feb. 17—Committee on inductive interference, Technical and Hydro-Electric Section, headquarters, New York. Committee on overhead systems, Technical and Hydro-Electric Section, headquarters, New York.

Feb. 26—Editing committee, Technical and Hydro-Electric Section, Chicago.

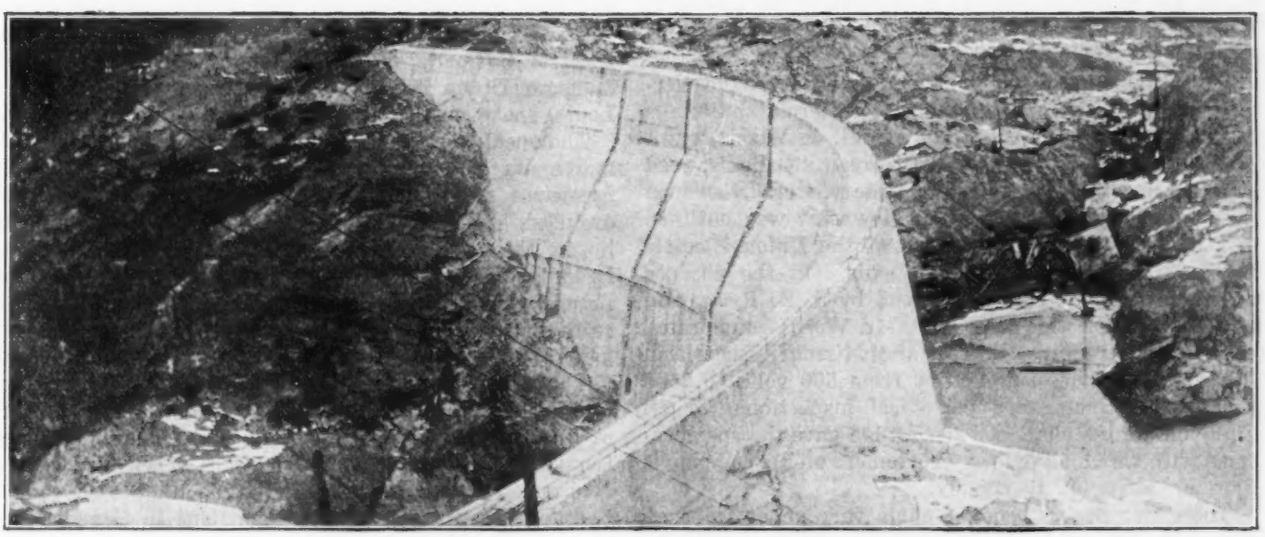
Feb. 27—Editing committee, Technical and Hydro-Electric Section, Chicago.

Poster Contest for the Cleveland Electrical Show

Chairman P. B. Zimmerman of the publicity committee for the Cleveland Electrical Show, to be held in Cleveland under the auspices of the Cleveland Electrical League March 10 to 20 inclusive, announces a contest for a poster drawing with which to advertise the coming show. The poster contest is under the direction of Henry Turner Bailey, dean of the Cleveland School of Art.

The sum of $200 is to be distributed in five prizes—$100 to the winner and $50, $25, $10 and $5 to the next four in order of the merit of their entries.

Winter Snows Lacking in High Sierras



In the year 1918-19 the snowfall in the high Sierras of California was the least of all the years on record. As a consequence power companies in California had great difficulty in operating hydroelectric plants throughout the entire season. The picture shows the snowfall on Jan. 1, 1920, at the Spalding Dam of the Pacific Gas & Electric Company to be unusually light. In fact, there is virtually no snowfall at all, and little storage of waters is possible.

Western Association of Electrical Inspectors Meets

Interesting Program and General Discussions in Which Many Members Take Part Mark St. Louis Convention

AFTER seven years the Western Association of Electrical Inspectors returned to St. Louis this week to hold its fifteenth annual meeting and to partake of the hospitality of the St. Louis Electrical Board of Trade. The business sessions occupied three full days and were largely taken up with discussions of methods by which experience and sound engineering principles could be utilized to reduce the cost of electrical installations without impairing their quality.

In the absence of President Charles K. Cregier of Chicago, the meeting was conducted by vice-president K. W. Adkins of Kansas City, who also replied to the address of welcome by Mayor Henry W. Kiel of St. Louis.

EFFECT OF DUST ON INCONDESCENT LAMPS

The first technical paper on the program was by Chester L. Dows, engineer of the National Lamp Works of the General Electric Company. He gave the results of tests and actual experience in the use of incandescent lamps in dusty places. These showed that the use of such lamps is safe when reasonable care is exercised in installation and maintenance. The maximum temperature which has been found on any type or size of incandescent lamps was about 360 deg. F. If only 300-watt type C lamps or smaller are considered, the maximum lamp temperature would be about 265 deg. F. when the lamps have become opaque from dust. This is about 200 deg. below the temperature at which the kind of dust commonly met with will ignite, though it will smoke at a lower temperature. The elimination of drop cords and frequent cleaning of the lamps were recommended in flour mills and other dusty places.

The paper was discussed by C. Renshaw of the Westinghouse Electric & Manufacturing Company, Victor H. Tousley of Chicago, R. L. Daniel of Minneapolis, W. L. Lodge of Chicago, C. E. Michel of St. Louis, O. M. Frykman of Minneapolis and B. H. Glover of Chicago.

The problems created by bringing high-voltage electric service into industrial and commercial buildings were considered from two angles. H. J. Woods, engineer of the Missouri Inspection Bureau, St. Louis, read a paper in which he gave the underwriters' views on the subject. A central-station viewpoint was outlined in a paper by Walter H. Millan of the Union Electric Light & Power Company, St. Louis. In the absence of the author this paper was read by J. H. Ryan, also of the Union Electric company. Mr. Woods enumerated some of the requirements of the Missouri Inspection Bureau for service supplied at from 500 volts to 3500 volts and recommended periodical inspections for all high-voltage installation. Mr. Millan gave the specifications with which all primary customers on his company's lines are expected to comply.

These two papers brought out a very general discussion. It seemed to be the opinion of the majority present that main switches and fuses should not be installed on the secondary side of users' transformers when there is a primary automatic switch which can be operated either electrically or mechanically from the outside of the transformer room. It was also agreed that such an arrangement would meet the requirements of the National Electrical Code. Victory H. Tousley led the discussion, which was also participated in by S. Legried of Springfield, Ill., H. F. Strickland Toronto, Canada; N. Rousseau of Chicago, F. O. Evertz of Columbus, Ohio; A. C. Schultz of Milwaukee, W. S. Boyd of Chicago, R. C. Loughead of Detroit, James H. Mahaney of Chicago, H. B. Gear of Chicago, H. W. Eales of St. Louis, L. Borer of Pontiac, Mich., and F. D. Varnam of St. Paul.

Last year the committee on rubber-covered wire gave a formula for figuring the number of wires of any size that could be used in conduit. The committee found that when large numbers of wires in a single conduit carry normal current the center wires may become dangerously hot. Therefore, in presenting the report of the committee this year, Chairman Tousley said that the number of wires in a conduit should not exceed nine and the I^2R loss of all wires should not exceed the maximum allowed under the code rules.

Among those who discussed the report were A. O. Boniface, L. A. Barley, F. O. Evertz, B. H. Glover, H. R. Cook, B. H. Glover and F. W. Derby of Chicago.

Victor H. Tousley, as chairman of the Committee on Demand Factors, recommended a graduated scale of demand factors down to 60 per cent for cranes. A special schedule is provided for apartment buildings. No action was taken, because the report had not been previously sent to members. J. H. Wood, F. O. Evertz, A. C. Schultz, S. N. Clarkson of Chicago, W. A. Haig, L. D. Smith, C. Renshaw, F. A. Barron of Schenectady and S. Legried discussed the report at considerable length.

REGULATING THE FIRE HAZARD

The obligations of manufacturers, electrical contractor-dealers and central stations to help regulate the electrical appliance fire hazard were recognized in a group of three H. J. Manger of the Edison Electric Appliance Company, Chicago, presented the manufacturers' side in a paper which was read in his absence by M. E. Long of the same company. The electrical contractor-dealers were represented by A. C. Brandt, department manager for the Frank A. Dam Electric Company, St. Louis, and C. E. Michel, sales manager Union Electric Light & Power Company, St. Louis, spoke on behalf of the central-station industry.

The speakers seemed to agree that the non-electrical merchants and manufacturers caused trouble by their ignorance of the conditions under which their goods are used. They advocated general education of the public in the correct use of electrical appliances. Mr. Brandt said that at present outlets were installed for illumination and that heavier wiring or separate circuits for appliances, though necessary, would not be generally used until the inspectors made it mandatory.

These papers were discussed by W. S. Boyd, John G. Gansber and J. Gallivan of Springfield, Ill.; L. Borer of Pontiac, Mich.; F. A. Barron of the General Electric Company, Schenectady; Victor H. Tousley and H. J. Hodson of East St. Louis.

An interesting account of conditions in Canada was presented by H. F. Strickland, chief electrical inspector for the Hydro-Electric Commission of Ontario. In Ontorio 660-watt sockets must be installed throughout. Steel service boxes and inclosed externally operated

switches have been used there for the past four or five years. Industrial plants are not required to take out individual permits. They pay an annual inspection fee and are inspected monthly. Inspectors go to the schools to teach children how they should handle electrical appliances. Mr. Strickland's address was discussed by W. S. Boyd, C. E. Mickel and H. J. Hodson.

During the sessions set aside for the discussion of inspectors' problems about twenty questions were placed before the meeting for information or action. The questions were discussed by B. H. Glover of Chicago, John Poehlman of Milwaukee, J. Gallivan of Springfield, Ill.; W. B. Doss of Nashville, Tenn.; A. D. Boniface of Chicago, E. R. Chincholl of Topeka, Kan.; W. A. Haig of Milwaukee, F. D. Varnam, Charles D. Fox of St. Joseph, Mo.; F. G. Waldenfels of Chicago, H. F. Strickland, Victor H. Tousley, S. Legreid, C. J. Wagner of Joliet, Ill.; T. W. Martin of Topeka, Kan.; C. Renshaw, J. W. Kelly, Jr., of Camden, N. J.; R. W. E. Moore of East Pittsburgh, Pa.; F. O. Everetz, L. D. Smith of Minneapolis, L. Borer, W. S. Boyd, H. J. Woods. O. M. Frykman, L. A. Borley of Denver, A. G. Shultz, H. M. Maxwell of Dayton, Ohio, and A. L. Eustice of the Economy Fuse Company.

It was the decision of the meeting that a separate circuit should be run for washing machines because of the necessity of overfusing.

In the opinion of the meeting metal molding and flexible armored conductor are not the equivalent of conduit wiring, though permitted to be used in some places.

Some interesting electrical fire-loss statistics were presented in a paper by Charles H. Lum of the National Board of Fire Underwriters, New York. The annual fire loss from electrical causes has increased $10,000,000 in four years. During a typical week in January, 1919, there were 540 electrical fires, of which 46.2 per cent were attributed to electric flatirons, 15.2 per cent were caused by flexible cords, 7.1 per cent by attic and basement wiring, and the remainder, 31.5 per cent, were due to miscellaneous causes.

Mr. Lum said that it was American carelessness that made electric service cause more fires than anything except matches.

B. G. Lamme Tells St. Louis Engineers of Synchronous Converter

LAST Wednesday evening a large gathering of electrical engineers of St. Louis were treated to an address on the development of the synchronous converter by B. G. Lamme, chief engineer of the Westinghouse Electric & Manufacturing Company. The meeting was under the auspices of the St. Louis Section of the American Institute of Electrical Engineers and was conducted by Chairman G. A. Waters.

The paper had been printed before the meeting, but the speaker enhanced its interest by speaking without referring to the printed sheets or to notes. Mr. Lamme was able to do this because the story was largely a record of his own and his associates' accomplishments in one particular line. The troubles experienced in the development of the synchronous converters were graphically told, and the parallel development of both engineering knowledge and larger machines was dwelt upon. It is now practicable to build synchronous converters of any rating that may be demanded; it has become a question of cost, not design. However, the upper speed limit appears to have been reached in 25-cycle machines, while higher speeds may be reached in 60-cycle designs.

The discussion was opened by H. W. Eales, who said the economic limit of 250-volt Edison distribution makes it desirable to use a number of comparatively small rotaries close to the load. The question of attendants' power, however, had compelled the use of large machines. The advent of automatic rotary substations for light and power service will, if successful, permit the use of a larger number of small substations. To supply new districts as the load grows, V. A. Flynn described some of the converting apparatus used in Europe.

The address was also discussed by J. L. Hamilton, A. H. Timmermann, S. N. Clarkson and H. Weichsel. Mr. Lamme, in replying to questions, said that the dynamotor, which is a converting machine with independent alternating-current and direct-current windings, would have nearly eight times the copper loss of a six-phase synchronous converter unless the amount of copper were greatly increased over that required for direct-current generators.

Electric Welding Companies Combine

A CONSOLIDATION of electric welding companies is being effected. The combined corporation will be called Associated Welding Companies, Inc. It will have 400,000 shares of authorized capital stock of no par value, of which 200,000 shares will be outstanding.

The consolidation is being arranged by J. M. Byrne & Company and M. J. Hoey & Company, bankers of New York, and is to include the following companies, of the capitalization stated: Electric Welding Company of America, New York, $1,000,000; Electric Welding Company of America, Baltimore, $150,000; Electric Welding & Shipbuilding Company of Canada, Montreal, $50,000; Electric Welding Company of America, Portland, Me., $50,000; Electric Welding Company of Boston, Boston, $300,000; Brooklyn Electric Welding Company, $50,000; New York Electric Welding Company, $25,000; Electric Welding & Ship Repairing Company of Pennsylvania, Philadelphia, $100,000; Electric Welding Company of America, Norfolk, Va., $100,000; Ohio Welding Company, Cleveland, $100,000; Electric Welding Company of the Argentine, Buenos Aires, $100,000; Compañia Soldatura Electrica de España, Bilbao, Spain, $100,000; Brooklyn Ship Repair Company, Brooklyn (no par value), 2,500 shares. The main office will be in Brooklyn.

Rates Made by Ohio Commission for Cleveland

Definite rates have been fixed for the Cleveland Electric Illuminating Company by the Ohio Public Utilities Commission. These rates have been used for some time but were not fixed definitely by the commission until Jan. 22, 1920. The rates for residential use are 10 cents per kilowatt-hour for the first 36 kw.-hr. and 5 cents for all in excess; for commercial users, 10 cents for the first 30 kw.-hr. and 3.5 cents for all in excess. This ruling ends a fight which started in 1914 when the City Council passed an ordinance seeking to compel a 3-cent rate.

Delegates to International Electrotechnical Commission, London, 1919

1. J. C. Holst, Norway.
2. Prof. A. Larsen, Denmark.
3. E. Huber-Stockar, Switzerland.
4. E. Brylinski, France.
5. Col. R. E. Crompton, C.B., honorary secretary.
6. Maurice Leblanc (past president), France.
7. Sir Richard Glazebrook, C.B., Great Britain.
8. L. M. Barnet Lyon, Holland.
9. Prof. A. Halleux, Belgium.
10. C. le Maistre, general secretary.
11. C. Rodgers, Great Britain.
12. A. de Montmollin, Switzerland.
13. J. A. de Artigas, Spain.
14. Ch. David, France.
15. P.Boucherot, France.
16. Motoo Uchisaka, Japan.
17. Dr. C. O. Mailloux (president-elect), United States.
18. Capt. J. Slee, R.N., Great Britain.
19. Guido Semenza, Italy.
20. Dr. M. de Haas, Holland.
21. Roger T. Smith, Great Britain.
22. Col. J. Lucas, Portugal.
23. Prof. T. Mather, Great Britain.
24. Don Serafin de Orueta, Spain.
25. Menezes de Oliveira, Brazil.
26. Warrington Chubb, United States.
27. M. Rechniewski, France.
28. A. R. Everest, Great Britain.
29. Prof. E. Morelli, Italy.
30. A. Smith, assistant.
31. C. H. Wordingham, C.B.E., Great Britain.
32. P. Good, assistant secretary.
33. A. P. Trotter, Canada.
34. A. J. Stubbs, Great Britain.
35. James Burke, United States.
36. H. M. Hobart, United States.
37. E. S. Lane, Portugal.
38. G. Arturo Pani, Mexico.
39. Sir William Slingo, Great Britain.
40. Major K. Edgecumbe, Great Britain.
41. Capt. W. T. Taylor, Great Britain.
42. Maurice C. Simpson, British Indies.
43. Miss M. Madell, assistant.
44. Dr. A. Russell, Great Britain.
45. Miss K. Alflatt, stenographer.
46. Motosuke Masuda, Japan.
47. C. Silver, assistant.
48. E. L. Litton, assistant.

Report on I. E. C. Meeting by Institute Delegates

American Committee Gives Information On Meeting of the International Commission Held in London in October, 1919

A REPORT on the meeting of the International Electrotechnical Commission in London last October has been made to the American Institute of Electrical Engineers by the Institute delegates who were present. Some information regarding the meeting was printed in earlier issues of the ELECTRICAL WORLD. As stated previously, the delegates were Dr. C. O. Mailloux, James Burke, H. M. Hobart and H. E. Chubb. Dr. Mailloux, who served as president of the United States national committee at the meeting, was unanimously elected president of the international commission for the next period.

Following is the analysis of the work accomplished at the London meeting as reported to the Institute:

So far as relates to the subject of rating of electrical machinery, the work accomplished falls into two categories. In the first category is the work which was ratified on Oct. 22, the last day of the plenary meeting. In the second category is further work done by the advisory committee on rating of electrical machinery, which continued in session for three more days. The work in this second category will be brought together as a recommendation of the advisory committee, and will not, until ratified at a plenary meeting, have the status of I. E. C. rules. Even the portion ratified at the plenary meeting was in the form of notes from which the editing committee of the I. E. C. was authorized to prepare the official report. This report will be the one submitted to the various national committees for study.

Consequently, at the present time, any statement of the things done must be made with reservations. It does not seem worth while to attempt to distinguish between the different degrees of completeness of the work done. The best that can be done is to state the general trend of matters.

I. For the purposes of the I. E. C. Standards, electrical machinery is for the present divided into two groups.

In the first group fall:

1. Rotating machines of which the terminal pressures do not exceed 5,000 volts, or of which the rated output does not exceed 750 kva., or of which the stator cores do not exceed 50 cm. in length, measured axially.

2. All transformers which are not water-cooled.

II. For machines in this group there are recognized only two methods of temperature measurement for acceptance tests, namely:

1. Resistance and thermometer, whichever gives the highest.

2. Thermometer measurements.

III. For machines whose terminal pressures exceed 5,000 volts, or of which the rated output exceeds 750 kva., or of which the stator cores have an axial length greater than 50 cm., a third method of temperature measurement—namely by embedded temperature detectors—was recognized by the advisory committee on rating. This has at present no more status than that of being the recommendation of that committee.

IV. The alternative of permitting thermometer measurements alone with a 5-deg. penalty, practically as customary in America, has been adopted by the committee on rating, although with certain modifications.

V. Commutators and slip rings are permitted to have any temperature consistent with successful operation, but if temperature rises of more than 50 deg. are employed for commutators the manufacturer shall give a special guarantee that the temperature obtained shall not impair the commutation.

VI. An ambient temperature of reference of 40 deg. C. for air was adopted for I. E. C. ratings.

VII. The I. E. C. committee on rating purposes to consider the adoption of an ambient temperature of reference for tropical ratings. Among the values mentioned informally, considerable stress was laid upon the appropriateness of 55 deg. If this should ultimately be adopted, it would amount to a 15-deg. lower temperature rise for machines with a tropical rating.

VIII. An ambient temperature of reference of 25 deg. C. for water was recommended for I. E. C. ratings by the advisory committee on rating.

IX. For water-cooled transformers the advisory committee on rating recommended that the limits for the highest observable temperatures shall be decreased by 10 deg. below those permitted for other machinery. Since the ambient temperature of reference for water is 15 deg. below that for air, this amounts to permitting a 5-deg. greater temperature rise for water-cooled transformers than for transformers of other types.

X. The advisory committee on rating recommends a temperature limit of 90 deg. C. for the oil in which transformers are immersed.

XI. The principle of correction back of shut-down is recognized.

XII. The permitted temperature limits for non-impregnated cotton, silk and paper are 15 deg. below the limits for these materials when impregnated.

XIII. The rule for the duration of the temperature test for a machine with a continuous rating is that the test shall be continued until it is evident that the maximum temperature rise attained would not exceed the prescribed limits if the test were to be prolonged until the final steady temperature were attained.

XIV. Very satisfactory progress was made by the advisory committee on rating in its recommendations concerning high-voltage tests. So far as the matter was carried, the rules recommended are in quite good agreement with those already adopted in several countries, including America.

Meetings of the advisory committees will be held in Brussels in the spring.

Legislation and Education Are Aims in Kentucky

In his presidential address to the Kentucky Association of Public Utilities Jan. 16 at Louisville, Harry Reid, president of the association and president of the Kentucky Utilities Company of Louisville, emphasized the importance of the utility business in Kentucky. The Kentucky association has thirty-three member companies, serving 104 communities.

The association has been operating on an income of about 800 a year, and President Reid pointed out that this should be increased to $3,000 a year for the benefit of the association and to permit it to continue legislative and educational work which it has under way. A considerable portion of the money will be expended for the issuance of a bulletin containing public utility information.

The convention program included addresses by D. L. Gaskill and I. Oppenheimer, of the Ohio Electric Light Association, on association work. Other features were addresses on legislation by L. B. Herrington, Louisville; on safety by C. B. Scott, Chicago, and on educational work by J. B. Mullaney, Chicago.

The election of officers resulted as follows: President, P. S. Pogue, Louisville Telephone Company; first vice-president, L. B. Herrington, Kentucky Utilities Company; second vice-president, John Stoll, Lexington Waterworks; directors, Donald McDonald, Louisville; J. C. Pope, Lexington; A. S. Nicols, Paducah, and W. A. Harton, South Covington; secretary-treasurer, J. B. Riley, Westinghouse Lamp Company, Louisville.

Power Production Report of the Geological Survey

Compilation for July, 1919, Shows that About 39 Per Cent of the Total Was Obtained from Water Power

A REPORT on the July, 1919, "production of electric power and consumption of fuel by public utility power plants in the United States" has been issued by the United States Geological Survey. It follows reports for February, March and April, 1919, previously issued by the Geological Survey. Apparently no reports are being issued for May and June

The July return is issued with slight corrections of the figures of power production and combustion of fuels put out for the earlier months. As now given, the totals of production for these months are as follows: February, production by water power, 1,148,634,000 kw.-hr., production by fuels 1,834,222,000 kw.-hr., total 2,982,-856,000 kw.-hr.; March, production by water power, 1,308,329,000 kw.-hr., production by fuels 1,841,542,000 kw.-hr., total 3,149,871,000 kw.-hr.; April, production by water power 1,308,573,000 kw.-hr., production by fuels 1,717,523,000 kw.-hr., total 3,026,096,000 kw.-hr.

The average daily output in kilowatt-hours was: February, 106,531,000; March, 101,609,000; April, 100,870,000; July, 101,366,000.

The percentage of total output produced by water power follows: February, 39; March, 42; April, 43, and July, 39.

Following are the statistics as issued for July:

State	Thousands of Kilowatt-Hours Produced		Combustion of Fuels		
	By Water Power	By Fuels	Coal, Short Tons	Petroleum and Derivatives, Barrels	Natural Gas, Thousands of Cu.Ft.
Alabama	28,442	3,689	15,458	8	.....
Arizona	7,478	18,877	7,315	61,030	.....
Arkansas	88	7,692	8,364	450	182,848
California	200,528	116,804	.....	550,799	242,228
Colorado	14,947	12,177	27,888	174	.....
Connecticut	5,943	48,182	67,513	213	.....
Delaware	.....	5,225	6,604	.....	.....
District of Columbia	.....	19,221	21,412	.....	.....
Florida	942	7,731	3,193	30,745	.....
Georgia	34,224	6,595	13,560	2,386	.....
Idaho	50,209	1,219	88	9	.....
Illinois	15,323	183,518	304,160	984	.....
Indiana	2,736	54,354	142,587	402	1,878
Iowa	51,802	24,531	69,703	720	.....
Kansas	981	35,068	50,817	60,742	80,846
Kentucky	4	19,205	39,390	341	.....
Louisiana	.....	15,518	11,324	30,508	63,624
Maine	17,678	220	534	.....	.....
Maryland	329	16,378	25,951	30	1,350
Massachusetts	15,163	110,467	130,506	21	.....
Michigan	50,043	108,402	129,612	204	.....
Minnesota	37,436	10,929	25,866	832	.....
Mississippi	.....	5,206	13,272	443	.....
Missouri	2,237	39,132	82,045	18,847	.....
Montana	83,220	848	4,894	502	912
Nebraska	1,302	16,602	31,904	3,387	.....
Nevada	2,559	720	195	1,780	.....
New Hampshire	4,499	3,814	5,808	3	.....
New Jersey	151	79,546	116,944	79	.....
New Mexico	144	1,603	4,133	1,610	.....
New York	212,033	276,828	336,004	1,224	56,949
North Carolina	45,317	7,243	14,915	20	.....
North Dakota	.....	2,449	14,806	553	.....
Ohio	2,378	208,240	283,658	689	*512,586
Oklahoma	161	13,826	8,717	20,067	474,930
Oregon	29,130	4,323	222	5,664	.....
Pennsylvania	52,648	238,021	388,957	297	40,531
Rhode Island	240	19,821	22,648	.....	.....
South Carolina	42,649	3,480	8,281	102	.....
South Dakota	3,468	2,920	6,841	3,192	.....
Tennessee	32,316	9,164	22,156	82	.....
Texas	191	45,537	29,269	188,691	114,148
Utah	12,405	.....	.....	.....	.....
Vermont	11,748	976	3,909	2	.....
Virginia	17,666	19,336	30,674	122	.....
Washington	79,881	5,434	2,060	22,071	.....
West Virginia	1,399	66,523	83,556	45	264,054
Wisconsin	41,512	27,637	46,221	574	.....
Wyoming	179	3,386	12,752	4,008	3,481
Total	1,213,729	1,928,617	2,676,688	1,014,652	2,040,365
Total by water power and fuels	.....	3,142,346	.....	.....	.....

* Includes 182,415 artificial gas.

An explanatory note issued with the statistics, which were prepared under the direction of A. H. Horton, says:

"These reports are based on returns received from about 3,000 electric power plants engaged in public service, including central stations, electric railways and certain other plants which contribute to the public supply. Returns were received from plants whose aggregate capacity of generators is about 90 per cent of the total installed capacity of public utility plants. Estimates of the output of plants which did not submit returns were made from available information. The figures given are subject to revision in subsequent statistical reports of the United States Geological Survey relating to power production."

Sir Oliver Lodge Discusses Atomic Structure

THE very close relationship between electricity and the physical sciences was pointed out by Sir Oliver Lodge in his lecture on "The Structure of the Atom" in New York City on Jan. 25. In the audience were many well-known scientists and engineers, making the gathering a notable occasion. The speaker explained that an unlimited supply of energy is bound up in matter, only awaiting sufficient progress in scientific research to find the means of releasing it.

Sir Oliver gave some idea of the characteristics of the electrons by pointing out that they move in infinitesimal orbits at the velocity of light (186,000 miles per second). The actual revolutions per minute, then, are of the order 10^{20}. The energy of one ounce of matter is thus equal to that now derived from about 1,000 tons of coal.

It was shown that the elements known may be classified according to the number of electrons which go to make up the atom of each, from the simplest (hydrogen) to the more complex such as uranium. This classification agrees very well with the older "periodic" system commonly used by chemists. It is upon the arrangement of the electrons in the atom of any element that its physical and chemical properties depend. Some idea of the size of the electrons may be had from the statement that 500,000,000 atoms would make up a train an inch long, whereas the size of an electron is to that of the atom "as a flea is to an opera house."

Many of the classic experiments were described which indicated the existence and later the properties of electrons.

Conference Club Meets to Discuss Industry Problems

A THREE-DAY meeting of the Conference Club was held at the Hotel Biltmore, New York, on Jan. 29, 30 and 31. Representatives of the other branches of the industry were present. The program included discussion by the contractors forming the club and by manufacturers, jobbers and central-station men. In addition to the business sessions a banquet was held. The meeting was held primarily to lay down a broad program for the future activities of the Conference Club and to make it of greater usefulness in helping to solve the problems of the industry as a whole.

F. S. Price Points Way Toward Co-operation

Prominent New England Jobber Advocates Defining Proper Spheres of Usefulness for Each Branch of the Industry

CO-OPERATION through specialization of functions and activities as a means of bettering relations within the industry was urged by Frank S. Price, president Pettingell-Andrews Company, Boston, before a meeting of the Boston district of the Massachusetts Association of Electric Contractors on Jan. 15.

Mr. Price said that he expected to see the volume of electrical trade double in New England during the next five years, and in voicing his desire to see all branches of the industry prosper the speaker recommended more direct contact between contractor-dealers and jobbers, the frank discussion of points of policy among representatives of different branches, the extension of organization influence throughout New England and a co-operative definition of proper spheres of activity, or an ethical code to aid all interests fairly to make the most of their opportunities.

The need of a spokesman for each local branch of the industry was touched upon by the speaker, who intimated that in the near future a New England electrical supply jobbers' club may be formed. A movement is also afoot to extend the Massachusetts electrical contractors' organization to cover New England activities outside of Connecticut, and a meeting to discuss this was scheduled to take place at Providence, R. I., Jan. 16, with the co-operation of the Narragansett Electric Lighting Company. A committee was appointed at the Boston meeting to discuss improved trade relationships with representative jobbers.

Mr. Price said that in his opinion the large industrial plants fall within the class of wholesale consumers and that the contractor-dealer cannot expect to serve these customers as well as can the supply jobber. On the other hand, small factories, hotels, buildings and other customers of a retail class should naturally be served by the contractor-dealer. Eighty per cent of all the fixture materials sold by Pettingell-Andrews are billed through local central stations or through contractor-dealers.

Regarding appliances, Mr. Price said that the jobber desires to sell these only at wholesale and asserted that in the case of his own house the volume of retail appliance sales is an insignificant percentage of the wholesale business. The speaker believed that if the central station retails along ethical lines and does business in accord with the contractor-dealer, it is a benefit to the industry for the central station to retail appliances. He did not favor jobbers engaging in contracting, or vice, versa, and maintained that where the jobber is assured of proper support he will generally be favorably inclined toward giving up the retail business. The same thing may be said of the central station in relation to the contractor-dealer. It is important for co-operation to be active in order that the merchandising of electrical supplies may be retained by the contractor-dealers instead of being allowed to fall into the hands of hardware stores and department stores.

Other speakers were H. A. Holder, Boston, who urged the maintenance of retail prices at the retail counters of jobbers, and W. F. Abely, assistant manager Western Electric Company, Boston, who said that a code of ethics would be most helpful in improving inter-trade relationships. The annual value of the electrical supply and construction business of New England, the speaker estimated, is now from $22,000,000 to $25,000,000.

Bituminous Coal Production Better, but Distribution Unsatisfactory

ACCORDING to the report of the Geological Survey, an increase of 185,000 tons carried the output of bituminous coal during the week ended Jan. 17 to the largest total attained in any week since the strike. Indeed the production was the largest in any week of January during the past three years, the period over which the Geological Survey's records of weekly production extend.

The total output for the week (including lignite and coal made into coke) is estimated at 11,655,000 net tons. Compared with the preceding week this was an increase of 1.6 per cent. Compared with the corresponding week last year it represented an increase of 1,772,000 tons, or nearly 18 per cent.

The year 1920 thus opens with production at a rate well above that of either 1917, 1918 or 1919. The total output since Jan. 1 now amounts to 27,925,000 tons, an increase over last year of more than 4,000,000 tons attained in fourteen and a third working days.

The week of Jan. 17 was the eleventh since the great bituminous strike began and the fifth since the miners generally returned to work. The strike is over, but its effects are still apparent in both production and distribution of coal. The men and mines are ready, but the extraordinary dislocation of the car supply necessitated by the strike has not yet been wholly corrected. Car shortages have therefore occurred frequently and unavoidably. With distribution proceeding irregularly local scarcities of fuel were bound to happen. To meet these difficulties vigorous measures are being taken by both the operators and the railroads.

Administrative Committee to Govern "Technology"

EVERETT MORSS, president of the Simplex Wire & Cable Company and chairman of a special committee of the executive board, Massachusetts Institute of Technology, which will serve in an advisory capacity in the management of the institute's affairs, has announced that no temporary successor to the late President Richard C. Maclaurin will be appointed. Other members of the special committee are Edwin S. Webster, of Stone & Webster, and Francis R. Hart, vice-president of the Old Colony Trust Company and treasurer of the Institute.

In place of a president *pro tem* the institute will be administered by a committee of three from the faculty, consisting of Dr. Henry P. Talbot, chairman of the faculty and head of the department of chemistry, Prof. Edward F. Miller, head of the department of mechanical engineering, and Dr. William H. Walker, director of the newly-established division of industrial co-operation and research. Frederick P. Fish, Boston, was elected chairman of the executive board at the meeting which decided upon the above administrative plan and made the appointments of the two committees named.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

A. I. E. E., Annual Convention.—The American Institute of Electrical Engineers will hold its annual convention from June 22 to 25.

A. I. E. E., Midwinter Convention.—Feb. 18 to 20 are the dates for the midwinter convention to be held by the American Institute of Electrical Engineers in New York City.

A. I. E. E., Philadelphia Section, and Franklin Institute Joint Meeting.—Prof. Comfort A. Adams, chairman of the electric welding committee, Emergency Fleet Corporation, will address a joint meeting to be held on April 8 by the Philadelphia Section of the American Institute of Electrical Engineers and the Franklin Institute, on "Electric Welding as Applied to Shipbuilding."

Institute of Radio Engineers.—A meeting of the Institute of Radio Engineers will be held on Wednesday, Feb. 4, at 8:15 p.m., at the Engineering Societies Building, 29 West Thirty-ninth Street, New York. A paper on "Multiplex Radio Telephony and Telegraphy," by F. M. Ryan, J. R. Tolmie and Roy O. Bach, will be presented by Francis M. Ryan, formerly at the University of Washington.

Ohio Electric Light Association.—The calendar of standing committee meetings is as follows: Meter committee, Feb. 14, joint meeting with N. E. L. A. at Cleveland, and April 22 at Columbus; new-business co-operations, lighting and merchandising section, March 10, at Dayton, and power and heating section, April 28 at Coshocton; transmission and distribution, Feb. 19 at Cincinnati, March 18 at Canton, and April 22 at Toledo; station operating, Feb. 18 at Toledo, April 7 at Cleveland and May 5 at Pittsburgh.

Pennsylvania State Association of Electrical Contractors and Dealers.—The annual meeting of this association will be held at Erie, Pa., on Feb. 18, with headquarters at the Hotel Lawrence. The tentative program includes a meeting of the executive committee at 10 a.m., a noonday acquaintanceship luncheon followed by an afternoon business session and a trip through the plant of the General Electric Company, concluding with dinner at 7 p.m., all branches of the electrical industry being invited. Information regarding space for display of electrical appliances, hotel reservations, etc., will be furnished by Paul Mueller, chairman entertainment committee, 604 Peach Street, Erie, Pa.

American Institute of Electrical Engineers.—The annual business meeting of the Institute is scheduled to be held in New York City on May 21.

A. A. E. Organizes Ohio State Assembly.—Representatives of all chapters of the American Association of Engineers in Ohio met in Columbus on Jan. 21 and formed the Ohio Assembly of the A. A. E. Members and applicants in Ohio now number about 1,500. Chapters are being formed at Canton, Youngstown, Newark and Marion. The existing chapters are Akron, Cleveland, Dayton, Cincinnati, Toledo, Ohio Valley, Steubenville, Ohio Northern and Columbus.

I. E. S., Philadelphia Section.—After Dr. Howard Lyon had talked on "Elementary Principles of Illumination for the Practical Man" at the Jan. 16 meeting of the section, M. Luckiesh made some interesting statements regarding the lighting of schools. Only nine out of the forty-nine states in the Union, according to Mr. Luckiesh, furnish proper artificial light in their schools. He gave figures to show that in some schools short-sightedness increases. Inverted translucent bowls were suggested as being best adapted to school lighting.

Mohawk Valley Engineers' Club.—With initial membership of about 125 the Mohawk Valley Engineers' Club, Utica, N. Y., was formed on Jan. 7, and the following officers were elected: President, Byron E. White, engineer Utica Gas & Electric Company; first vice-president, Hubert E. Collins, consulting engineer; second vice-president, Roy F. Hall, division engineer State Highway Department; third vice-president, Horace B. Sweet, consulting engineer; secretary, Frederick E. Beck, engineer Consolidated Water Company; treasurer, Clifford Lewis, Jr., civil engineer. Regular monthly meetings are held the first Tuesday of each month.

Question-Box Convention, New England Section, N. E. L. A.—The New England Section of the National Electric Light Association will hold a "question-box conference" at the American House, Boston, on March 18. Live commercial topics will be discussed at the sessions, with accounting, advertising, electric vehicle, power and lighting matters prominent on the program. The New England Section recently "signed up" its 1,200th member and is having an active season. At the first electrical luncheon for the year, held on Jan. 21, F. G. R. Gordon of Haverhill, Mass., addressed about 150 members and guests on "Bolshevism, Its Cause and Cure in the United States." The advertising committee held a meeting Jan. 21 at the Engineers' Club, Boston, which was attended by prominent representatives of manufacturing and central-station companies, including several from outside New England, and the electric range committee is actively engaged in furthering the development of this class of equipment through organized effort.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Temporary Rates Made Permanent.—The Illinois Public Utilities Commission has entered an order in the case of the Citizens' Gas, Electric & Heating Company of Mount Vernon, Ill., continuing in effect indefinitely rates for electric service which had been authorized temporarily Sept. 19, 1918. This order places the burden of proof of the reasonableness of the rates upon the company if complaint is filed.

Consolidation of Illinois Properties.—The Illinois Public Utilities Commission has authorized several purchases and consolidations recently. The commission has authorized the Central Illinois Public Service Company of Mattoon to purchase the entire capital stock of the Central Illinois Utilities Company, the property of which centers around Paxton, the Hoopston (Ill.) Gas & Electric Company, the Hamilton Utilities Company and the Eastern Illinois Ice Company for the purposes of merger and consolidation. This in effect consolidates definitely certain properties which were recognized as members of the Insull group. The Southern Illinois Light & Power Company has been authorized to purchase the property of the Wright Brothers Light & Power Company at Ramsey, and the Lee Power & Light Company has been authorized to purchase the electric property of John E. Malmberg to operate in the village of Lee.

"Seasonal" Rates in Maine.—The Maine Public Utilities Commission has decided in the case of J. L. Katterlinus, E. H. Macomber and others against the Bar Harbor & Union River Power Company that the rates, schedules and practices of the company are unlawfully discriminatory. The decision orders that on or before April 1, 1920, the company file a schedule of rates, services and practices, to be effective on or before May 1, 1920, and that the lighting rate for a "seasonal" customer shall be 20 cents per kilowatt-hour and for a "year-round" customer 13 cents per killowatt-hour, a reclassification of customers to whom it offers service of any sort clearly setting forth in sufficient detail the time, condition and other elements relative to the use of service upon which each such classification is based and the rate at which any service will be rendered and such changes as may be necessary in any of the so-called terms, conditions or rules relating to any service offered. If the company desires, it may at the same time revise or amend its schedule in the so-called "Ellsworth" district.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

New England Power Company Paper.—The New England Power Company has established a monthly paper in the interest of its employees.

Ask Enlargement of Coal Commission.—It is reported that representatives of five groups of public utilities in Indiana have petitioned President Wilson to enlarge the Coal Commission, increasing the public representation.

Change Name of Mahoning & Shenango Company.—Stockholders of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, have voted to change the name of the corporation to Pennsylvania-Ohio Electric Company.

Urges Steam Railroad Electrification for Atlanta.—City Electrician R. C. Turner of Atlanta, Ga., in his annual report recommends that with the return of the railroads to their owners the City Council should begin a movement to require electrification within the city limits.

Electrical Development in Finnish District.—U. S. Consul Parker W. Buhrman writes from Helsingfors, Finland, that a stock company has been organized in the communities of Middle Osterbotten, Finland, for the development of the water power of Korpela Falls on the Lestijoki River. The total cost of the development is estimated at 2,190,000 marks (now about $110,000).

Electrical Fires Small Percentage.—Owing to co-operation of the Dayton (Ohio) Power & Light Company and the officials of the local fire department, the practice of charging to electricity all fires of mysterious origin has been largely eliminated. The employees of the electric light company and the officials of the fire department jointly investigate all fires in which the cause is not readily apparent. The following statistics showing the causes of the fires in the year 1919 bring out that of the total number of fires, which was 1032, only nine were chargeable to defective wiring, and there was a total of only fifty-two electrical fires. The fires in Dayton were charged to the following causes: Chimneys, 456; coal stoves, 19; coal furnaces and boilers, 53; electric, 52; gas, 67; gasoline, 8; gasoline automobiles, 39; gasoline automobiles in garages, 19; oils, 7; miscellaneous, 312. The electrical fires were divided as follows: Defective wiring, inside, 9; defective wiring for motors, 7; defective wiring for street cars, 8; defective aërial wiring, 24; electric ironing exposures, 4; total, 52.

Engineering Council Needs Support.—The Engineering Council has issued, through Alfred D. Flinn, its secretary, an appeal for contributions to aid its work for 1920. It needs to carry out its proposed work an income of $45,000 in the year, of which $30,000 is desired from general contributions. From the four founder societies $12,000 will be received and from other member societies $3,000. For 1919 the total income was $50,000, including $25,000 advanced by Chairman Channing and not yet repaid. Letters have been sent to 50,000 engineers to meet the emergency.

Pacific Coast Section, N. E. L. A., Issues Press Service.—In connection with the widespread newspaper advertising campaign now being conducted by the electrical industry in the West, the Pacific Coast Section, National Electric Light Association, is publishing a complete press service which is sent regularly to the editors of this section of the country. All phases of "happenings in the industry" are included, from the broad policies of central stations to the development and use of electrical appliances. It has been found that the newspapers which are running electrical advertising pages welcome this prepared material, printing it usually in connection with those pages. The press sheets are prepared directly under the supervision of the chairman of the publicity committee, I. W. Alexander of the San Joaquin Light & Power Corporation, Fresno.

Brooklyn Edison Dinner to Industrial Leaders.—The Brooklyn (N. Y.) Edison Company tendered a dinner on Jan. 13 to a representative gathering of men who have made Brooklyn's industrial history. Among the more than 350 guests were the heads of large financial enterprises and officials of the city. The spirit of the dinner was set forth on the walls of the ballroom of the Hotel Bossert in electric letters—"Boost Brooklyn Products" and "Be a Better Brooklynite." The electric decorations were lavish. The principal address was made by Lewis H. Nixon, Public Service Commissioner, who spoke on the regulation of public utilities. M. S. Sloan, president Brooklyn Edison Company, spoke on the growth of the company and of its efforts in endeavoring to keep stride with the remarkable expansion of Brooklyn industries in the last few years. Theodore I. Jones, general sales agent of the company and toastmaster of the dinner, presented an exhaustive survey of the industrial situation in Brooklyn. William E. Halm, president New York Dock Company, spoke on "Some Phases of Brooklyn's Industrial Development." Borough President Riegelmann touched on the marginal railway, the Jamaica Bay development and the general expansion of Brooklyn. Brigadier General G. H. Harries, who represented the Allied forces in Berlin directly following the armistice, told of some of his experiences while in the capital of the former German Empire.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Review of Public Service Commission's Proceedings.—For purposes of petition for writ of certiorari to review an award by the Public Service Commission, the Supreme Judicial Court must accept as final the commission's finding of fact, according to a decision of the Supreme Court of Massachusetts. (125 N.E. 176.)

Powers of Public Service Commission.—No arbitrary powers were given by statute to the Public Utilities Commission, according to a decision of the Illinois Supreme Court, and its orders and decisions are subject to review and must be reasonable and lawful. When a public utility files a petition for a certificate of convenience and necessity it is the plain duty of the commission to consider the petition on its merits, and if the public convenience and necessity are shown, the certificate must be granted. (125 N.E. 373).

Law of Eminent Domain.—Commissioners of appraisal, in appraising value of property of water-power owner claiming damages because of the closing of reservoir gates, had, the Supreme Court of New York holds, in E. I. du Pont de Nemours Powder Company vs. City of New York, no right to consider the opinions of experts based on the assumptions that claimant had a right to a dam making a 40-ft. head where there was a strip of land under water over which claimant had no flowage rights and where the only right that claimant had acquired by adverse possession was to flood the land to the level of a 24-ft. dam. (179 N. Y. S. 122).

Impairment of Contract Obligation by Municipality.—It has been declared by the Supreme Court of the United States, in Hardin-Wyandot Lighting Company vs. Village of Upper Sandusky, that an electric light company which received a franchise to use the streets of a village when a statute provided that the "mode" of use thereof should be such as should be agreed on by the village authorities and the company, or, if they could not agree, as should be directed by the Probate Court, did not have the obligation of its contract impaired by a law afterward passed by the Ohio Legislature, in the exercise of police power, which gave to the municipality complete control over the placing in the streets of poles and wires by such companies; that is where the effect of the statute is not extended to poles and wires in use at the time but is limited to restoration of those that had been removed and to additional construction. (40 S. C. R. 104.)

A. G. Buckholz, who has been connected with the Union Light, Heat & Power Company at Fargo, N. D., in various capacities, has been appointed accountant for the Red River Power Company, Grand Forks, N. D., a subsidiary of the Northern States Power Company.

Louis H. Bean has resigned as general manager of the Tacoma (Wash.) Railway & Power Company to become vice-president of Dwight P. Robinson & Company, consulting engineers, New York. Mr. Bean was with the Tacoma company for nine years. He is now making a trip through the Orient.

Frederic Nicholas, contributing editor of the ELECTRICAL WORLD, has resigned, effective on Jan. 31. Mr. Nicholas began his service with the McGraw Publishing Company in May, 1908, as a result of the consolidation of the *Street Railway Journal* and the *Electric Railway Review*, forming the *Electric Railway Journal*. He had been associate editor of the *Electric Railway Review* and the *Railway Age*, then published by the Wilson Company, Chicago, from January, 1907. His work with the McGraw Publishing Company was at first mainly on the *Electric Railway Journal*, with occasional contributions to the ELECTRICAL WORLD. Later he divided his time about equally between the two papers. For some years his work has been entirely on the editorial staff of the ELECTRICAL WORLD.

Vernon M. F. Tallman has been appointed power engineer for Charles H. Tenney & Company, with headquarters at Boston, Mass. Mr. Tallman is well known among the younger New England central-station men. He is a native of Newport, R. I., and was graduated from the Massachusetts Institute of Technology in the electrical engineering course in 1914. He entered the employ of the Worcester (Mass.) Electric Light Company in that year as assistant to the superintendent of distribution, and after a year of varied work in different branches of the company's service he was transferred to the power sales department. Here he established a reputation in commercial engineering which spread beyond the bounds of the local central-station system and which has been influential in the rapid expansion of the company's business. Mr. Tallman is chairman of the New England Association of Central Station Power Engineers, a closely knit organization of specialists in this branch of utility service, and at the time of leaving Worcester he was vice-chairman of the Worcester Electric Light Company section of the National Electric Light Association. Just before his departure for the Tenney organization he was presented with a gold wrist watch by fellow employees of the Worcester company, Harry D. Stokes, head of the power sales department, being master of ceremonies. In his new work, which began at Boston Jan. 2, Mr. Tallman will have charge of power engineering in all branches of the Tenney service.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

H. W. Graeber, assistant superintendent of the Oklahoma Gas & Electric Company at Oklahoma City, Okla., has been advanced to the position of superintendent, succeeding H. W. Reilly, who on Jan. 1 was appointed vice-president of that company in charge of operation.

W. C. Anderson, statistical secretary and secretary of the Technical and Hydro-electric Section of the National Electric Light Association, has left the association to join the staff of R. J. McClelland & Company, 100 Broadway, New York, recently formed to handle investment securities. Just before leaving the N. E. L. A. Mr. Anderson was appointed secretary of a special committee on geographical sections. His committee work is being taken over by A. Jackson Marshall, who is also secretary of the Electrical Vehicle Section and executive representative of the Commercial Section.

Walter C. Fish, manager of the Lynn (Mass.) Works of the General Electric Company since 1894, has resigned and accepted the position of manufacturing engineer of the International General Electric Company. Mr. Fish was graduated from Harvard College in 1886 and received the degree of B.S. in electrical engineering from the Massachusetts Institute of Technology in 1887. As an executive engineer he has established a high reputation, and last fall he returned from Europe after a six months' study of conditions in the foreign field, drawing up a program for the development of overseas business. He first went to Lynn in 1891 as assistant to E. W. Rice, Jr., then general manager of the plant. Mr. Fish was scheduled to sail for Europe again on Saturday of last week to take up his new duties.

Obituary

Robert K. Sheppard, formerly president of the Associated Manufacturers of Electrical Supplies, died at his home in Newtonville, Mass., on Jan. 22. After his resignation as sales manager of the Simplex Wire & Cable Company, Boston, in the spring of 1919 he suffered a severe physical breakdown, from the effect of which he had never recovered. Mr. Sheppard's largest service to the electrical industry was in the organization of the Associated Manufacturers of Electrical Supplies, in which he was the prime mover. He saw the value of such an organization, and found able support for the steps which led to the formation of that now important association. He was its first president, serving in that capacity for two years and retiring only because of his belief that rotation in office was desirable. He served continuously as a member of the board of governors. Mr. Sheppard was born in Boston in 1871. He was graduated from Massachusetts Institute of Technology in 1895. He entered the employ of the Washburn & Moen Manufacturing Company and remained with that company and the American Steel & Wire Company, which absorbed it,

R. K. SHEPPARD

until 1912. He served in different capacities with that company, representing the insulated wire department in New York and Chicago and having charge of the Philadelphia office for eight years prior to his retirement in 1912. He then became connected with the Diamond Rubber Company, Akron, Ohio, and when it was consolidated with the B. F. Goodrich Company, became connected with the latter company. He resigned his position as manager of sales for the insulated wire department of that company in 1915 to enter the Simplex Wire & Cable Company, from which the resigned last year.

Nathan Corning Kingsbury, who for last nine years had held the position of first vice-president of the American Telephone & Telegraph Company in charge of operation and public relations, died of heart disease on Jan. 24, at his residence in New York City. Mr. Kingsbury was born at Mentor, Ohio, July 29, 1866. He entered the telephone field in 1906 as vice-president of the Michigan State Telephone Company, with headquarters in Detroit. He was elected president in 1907, and during the several years of his connection with the company its lines were extended and the service was placed on a very efficient basis. On Jan. 1, 1911, he became first vice-president of the American Telephone & Telegraph Company and removed to New York City. He continued as a director of the Michigan State Telephone Company, and was also a director of several other companies.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Improvement Shown in Early Fan Ordering

JOBBERS and dealers are already ordering fan motors for the coming season. More orders are being placed than usual, and the orders are also larger. Constant directing of attention on this phase of the fan situation is gradually bearing fruit, and jobbers and dealers are coming more and more to understand the necessity of anticipating the season and having the fans in their stock when the call comes. There were many cases of lost sales during the past season because of short fan stocks, and it is evident that less of that can be expected this year.

It is not possible to predict in May better than in January the kind of fan season that will be encountered from June to September. On the other hand, manufacturers stand a better chance of filling orders received in January than those received in May and June. Some dealers who used to order ten fans in the initial order are this year placing orders for about twenty-five. As far as can be seen, there is sufficient raw material available to supply the entire season if manufacturers do not have to wait till midseason to turn raw material into fans.

Inclosed Externally Operated Switches Gaining Rapidly

TO THE observer of trends in the electrical industry it must now be apparent that the inclosed externally operated type of knife switch will sooner or later supersede the open knife switch for all applications except those regularly handled by skilled electrical workers. The curve of progress rose slowly at first but in the last few months it has shown marked upward tendencies. There are reasons to believe that the production at the present time of inclosed switches is around 100,000 monthly, while the approximate production of open knife switches for applications other than on panelboards, etc., is estimated variously at from 55,000 to 100,000 monthly.

In the early days of American wiring it was thought necessary in the interests of safety to inclose electrical circuits. The use of conduit was developed for this purpose. The switch, however, was still left exposed, in spite of the fact that it was approached as a rule more frequently than other parts of the circuit. That it was not inclosed before is due perhaps to two causes—first, some mechanical ingenuity was required, and second, the switch was usually backed by an insulating base and provided with an insulating handle, both of which, it was thought, might properly be expected to safeguard it sufficiently. The English, on the other hand, were more thorough in their electrical safety engineering. They inclosed their switches at the same time or shortly after they inclosed their conductors.

When this difference in practice was noticed in this country an attempt was made to introduce English inclosed switches into the United States. Because the English switches needed Americanizing to rid them of excess weight and high cost, the attempt was unsuccessful. Development in the inclosed knife switch field for several years has centered in this idea of retaining safety at lower cost. Several concerns have worked simultaneously on the job, so that no one firm holds control of all desirable patents. In fact, the patents which are useful are fairly well distributed among the fifteen manufacturers. Apparently there is opportunity for any maker of open knife switches to secure a license and get into the new field, and most of them have done so already.

In the trade jobbers and dealers, generally speaking, have stocks of open knife switches varying in size. However, it is doubtful if the time will ever come when it will be as easy as it now is for the trade to dispose of its stocks of these switches in view of this later development. In spite of the fact that the inclosed switch is most surely here to stay and is increasing in numbers it is not necessary, even where safety switch laws have been passed, to unload with precipitation at a sacrifice in price. In stocking switches, however, it would be well for the trade to bear this development in mind. The trade will not be slow to do this because the inclosed externally operated switch is more attractive than the open knife switch as a merchandising proposition. It is likely to become increasingly so as discounts to recognize the electrical contractor and dealer are arranged by more switch makers.

Attachment Plug Patent Cases Appealed

IT WAS announced in the Jan. 17 issue of the ELECTRICAL WORLD, page 184, that Judge Thomas had found infringement by the General Electric and the Bryant Electric Companies of Hubbell's patents 774,250 and 774,251, and it was stated that he held the Burton patent invalid. It has now been drawn to the attention of the ELECTRICAL WORLD, however, that the decrees which Judge Thomas entered in those three cases were entered last October and were all expressly stated to be *pro forma*, and that Judge Thomas did not write any opinions but merely expressed formal conclusions in order that, as he stated, "there may be no further delay in moving forward to the Circuit Court of Appeals." In other words, in no sense has there been a decision on the merits in any of the cases in question. Judge Thomas, since hearing the cases, has been part of the time ill and part of the time too busy to go into the merits of the patents and write opinions. The formal injunctions which were entered in the cases on the Hubbell patents were suspended, the three cases were all appealed to the United States Circuit Court of Appeals, and it is expected that they will be reached for argument and decision in the course of the next two or three months.

Shipments Long in Porcelain Industry Because of Curtailed Production

RECENT price advances in the high-tension insulator market have been attributed to labor. Effective Jan. 17, pin-type insulators and suspension-type insulator accessories were advanced 10 per cent in price, while suspension-type insulators and bushings went up 5 per cent. There is no inference that labor all along the line has received increases commensurate with the advance in price. The labor market is not only short in the pottery mills but also extremely unstable. Constant goings and comings greatly curtail production, because of the breaking in of new men, and it is expected that the percentage of damaged stock will mount. In one case this cutting of production has amounted to as much as 40 or 50 per cent.

At the same time, orders are extremely high. Consequently shipments, which under normal conditions would be around six weeks, have advanced to as long as three and four months. For certain lines of insulators, to be sure, shipments can be made in shorter time than sixty days, because machinery, materials and labor are available for this work. Car shortage also affects shipping dates in respect both to incoming raw materials and outgoing

finished product. Shipping schedules embrace dates as long ahead as May and June.

As far as can be learned, there is sufficient raw material, both domestic and foreign, to satisfy the demand.

The low-voltage porcelain market — knobs, tubes and cleats—is in a similar predicament. In this case, however, all prices have been withdrawn and price at time of shipment rules. Shipments, too, are very long, with production booked up through the first half of the year. In addition, it has been stated by a leading authority in the low-voltage porcelain field that orders are six months behind and that by June the entire 1920 production will be booked. Orders are very large, but here, too, production is below capacity; a particular shortage of molders exists.

The export market shows considerable activity despite unfavorable exchange. Virtually no European country is in a position to supply any quantity of insulators, particularly high-tension type. The amount of hydro-electric work now under way on that continent and in the Far East provides a good market for this material, and the outlook in that direction is unusually bright. Moreover, it appears that there is not at present sufficient capacity available to supply both the foreign and domestic market at the rate of production now prevailing.

Southern Market Is Rapidly Expanding

PROBABLY no part of the country has changed or progressed more than the South in the last five years. In what was almost wholly an agricultural country, prosperous industrial and mining developments are growing up. Five years ago the prosperity, and therefore the potential market, of the South was good or bad in accordance with the condition of the cotton crop. While this crop is still looked upon as the ready-money crop, its relative importance has steadily declined. Neverthelss, cotton, the "barometer industry of the South," so called, will this year reach a total value of $2,250,000,000. The total worth of the agricultural products of the South for 1919 has been estimated at $6,000,000,000, which is $1,500,000 in excess of the figures for the year of 1918, the greatest year in the South's history.

The industrial activity of the South has served to bring about a large influx of population, which in turn has caused the housing situation in most Southern cities to become acute. The growth of business and expansion of industries have made serious inroads into office space until it is almost impossible to obtain adequate office facilities in the more desirable sections of the principal cities. The summary by the Sixth Federal Reserve district for the last three months of 1919 building activities in twenty-seven of the Southern cities is 3,430 repair and addition permits, valued at $2,660,836, and 2,261 new permits, valued at $9,753,142. These figures do not include any construction in cities of less than 5,000 of population nor the permits for any of the large centers in Louisiana, North and South Carolina, Arkansas and Texas. Every indication at the present time is for a great period of improvement and expansion, stimulated by the huge sums of money in the hands of the rural population.

Many Localities Without Service

Of the cities and towns in the South only approximately 1,150 now have electric lighting service. Many of those without it are preparing to install distribution systems, while many more will avail themselves of the farm and residence lighting outfits that can be obtained at the present time. Poles, pole-line hardware, wire and all of those classes of material which must be had for electrical installations will experience a steady and growing market.

Owing probably to the fact that the population is largely native-born, the South has been and is remarkbly free, comparativly speaking, from labor troubles. Foreign capital, therefore, has been encouraged in the establishment of many large plants in this section. There are proposed or building today 182 new textile mills and 104 additions to existing mills, in addition to the construction of a large number of oil wells and fertilizer plants and other industries, each of which will require more or less electrical equipment for its operation. During the continuation of war conditions nearly all central stations ceased making extensions and improvements, but there is now a noticeable tendency to begin again activities along this line.

A new ruling placing export rates to Southern ports on an equal basis with the rates to the big centers in the East will undoubtedly be a great stimulant to the Southern export trade. To handle this trade adequately, however, there must be a material increase in terminal and docking facilities, coaling stations and other requisites of a deep-water port.

The jobbing and manufacturing trade in this section are aware of all the conditions outlined above and are unanimous in predicting for 1920 the greatest year in their history. A glance at some of their prospectuses might be of interest. One of the largest manufacturing-jobbing firms places its estimates of the increase of 1920 over 1919 at 20 per cent over all, while an itemization of its estimate shows increases, as follows: farm-lighting outfits, 60 per cent; specialties and heating devices, 40 per cent; pole-line material, 15 per cent; schedule and building material, 15 per cent; industrial equipment, 20 per cent. Another manufacturing jobber, while reporting an expected slump in large turbo-generator sales, feels that this loss will be fully offset by an increase of 15 per cent in industrial motors and transformers, while the sale of schedule material, special industrial apparatus and electrical specialties will be limited only by the manufacturers' ability to furnish the goods. In anticipation of this future market, a number of the larger jobbers have recently established branch offices in Southern cities, while the three principal manufacturing jobbers are taking immediate steps to provide additional warehouse space to meet the growing demand, their present facilities having become outgrown. Several companies report the need of more traveling representatives.

Heavy Stocks Will Be Needed

It is difficult, if not impossible, therefore, to pick any one line of electrical material as being worthy of especial notice, for all of the better classes of construction must of necessity include a large slice of business for the manufacturer and jobber of electrical lines. The concensus of the trade's opinion is that the difficulty will not be to find a market for stocks but to find stocks to meet the demand of a wide and steadily growing market.

The period of prosperity and general optimism undoubtedly has a tendency to breed a spirit of recklessness in purchasing and stocking and in the extension of questionable credit. Conservatives are arguing that accounts should be scrutinized just as carefully as ever and the general pyramiding of orders be avoided; for should the supply catch up with the demand, many of those pyramided orders will melt away; and there are some who feel that the supply will catch up with the demand by midsummer of 1920 and that prices have about reached their peak. The conservatives, therefore, are buying freely but cautiously and are avoiding heavy purchases for speculative purposes.

Manufacturers in United States Urged to Accept Canadian Money

THE exchange rate between United States and Canada has had a marked affect on exports of American goods over the border. Canada is the largest foreign consumer of electrical goods made in the United States. While a number of American electrical companies have already established Canadian factories, others have not, and it is these who will suffer very materially unless some solution is found quickly.

Frederic Nickolls, president Canadian General Electric Company, Ltd., and Canadian Allis-Chalmers, Ltd., Toronto, Ontario, in a letter to American manufacturers outlines the situation and recommends that, notwithstanding the existing difference in exchange between the two countries, the manufacturers on this side of the border accept payment of their charges in Canadian funds. These they can deposit in banks in Canada or utilize in settlement of their Canadian commitments.

Rigid-Conduit Prices Expected to Go Higher

WITH the $7 advance in price of merchant pipe at the mills last week, the way seems to be clear for an advance in price of rigid conduit almost any day, as the price of electric pipe is closely related to that of merchant pipe. Information from conduit manufacturers shows that such an advance is expected. All rigid-conduit prices are now subject to price at time of shipment. Shipments which may be made from the mills today may be based on card 43, those made tomorrow may be on card 44, while those made next week may be on a still higher card. The price situation is so uncertain that no guess whatever can be hazarded as to when and how much it will advance.

Output of rigid conduit is badly curtailed. Shortage of coal and coke is keeping some furnaces down, this in turn reacting upon the amount of finished product which can be turned out by the mills. Steel-mill labor, too, is short; and in addition the freight-car shortage has a further direct bearing on supply of coke to the mills and of finished product away from them.

Rigid-conduit capacity is in general booked well up through the first half year, which brings shipments up to five months. At the same time a manufacturer would undoubtedly ship out of his warehouse by truck a few hundred feet of pipe for a contractor who was about to pour concrete and who really had to have it. Some jobbers' prices are a little higher this week on black pipe, probably because stocks are so very low. Galvanized pipe stocks are somewhat better than those of black.

Metal Market Situation

Producers' prices for spot and first-quarter electrolytic copper are quoted at 19.25 cents delivered, and second-quarter at 19.37½ to 19.50 cents a pound. The outside market is making some sales as low as 18.50 and 18.62½ cents for quick delivery, but there is little metal at that figure. Most outside sales are at 18.75 to 19.00 cents spot. Second-quarter sales are a little better at 19.50 and 19.62½ cents. The copper consumers are well supplied for nearby use, and a continuing quiet although strong market is expected for a short time. New drops in foreign exchange are making it still more difficult to trade abroad.

The official lead price remains at 8.50 cents this week, although the outside market is a quarter cent higher.

Antimony is strong, showing an upward revision to 11.12½ cents.

The used market is off about a quarter cent in several lines.

Although the principal steel interest is holding fast to prices as of March 21, 1919, other interests have made several upward revisions on steel and iron. As far as can be seen the end of these advances is not yet in sight.

NEW YORK METAL MARKET PRICES

	Jan 20			Jan. 27		
Copper:	£	s	d	£	s	d
London, standard spot	116	5	0	119	15	0
	Cents per Pound			Cents per Pound		
Prime Lake	19.50 to 20.00			19.50		
Electrolytic	19.00 to 19.25			18.75 to 19.00		
Casting	18.50 to 18.75			18.50		
Wire base	22.25			22.25		
Lead, trust price	8.50			8.50		
Antimony	10.62½			11.12½		
Nickel, ingot	42.00 to 43.00			43.00		
Sheet zinc, f.o.b. smelter	12.50			12.50		
Spelter, spot	9.50			9.50		
Tin, straits	64.00			62.50		
Aluminum, 98 to 99 per cent	31.50 to 32.50			31.50 to 32.50		

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	18.00 to 18.25	17.75 to 18.00
Brass, heavy	10.50 to 11.00	10.00 to 10.50
Brass, light	8.75 to 9.00	8.50 to 9.00
Lead, heavy	7.00 to 7.12½	6.75 to 7.00
Zinc, old scrap	5.25 to 5.50	5.00 to 5.25

THE WEEK IN TRADE

EXCEPT for the West coast, a heavy volume of business is reported from all sections. Deliveries are in general slower because of car shortages and other transportation difficulties. New England has placed a light embargo on certain freight shipments.

Stocks, however, are improving for such materials as rubber-covered wire, sockets, snap switches and lamps. Most wiring materials are short, especially pipe, loom, flexible metallic conduit, flexible armored conductor and outlet boxes. Motor demand is good, and in the South and West farm-lighting sets are selling well. Heavy orders from the Midwest for power cables are not expected to have much adverse effect on mill shipments.

Washing machine prices are reported $50 higher, while small advances have been applied to insulating compounds, lamp cord, magnet wire and X-ray lighting equipment. Pipe and outlet-box prices are expected to advance although on a price at delivery basis.

Surplus electrical equipment sold by the Government up to the end of 1919 brought $637,190. The original cost of the equipment was $1,080,440.

NEW YORK

All wiring materials are moving in very large volume, that is, up to the capacity of available material. It is with difficulty that stocks of these materials, excepting rubber-covered wire, can be accummulated. In many cases incoming shipments are immediately apportioned on waiting orders and do not find their way to the stockroom. Lamp stocks are building up again after a shortage a few weeks ago. Galvanized pipe is somewhat more available than the black, although in itself low. Outlet boxes are particularly low. Conduit prices are very unstable and are expected to advance because of a recent advance in merchant pipe at the mills. Condulets, taplets and the like are of different material and no advance has been predicted for them at this time. Outlet-box prices are also expected to increase. Lamp cord, heater cord and magnet wire are somewhat higher, in some cases to discourage ordering in an already overbought market. Insulating compounds are up a little. Fiber conduit is moving in good volume, and power cable is undergoing a demand which is setting ahead shipments to April and May. Collections are good.

Insulating Materials.—Recent price advances in the basic ingredients of insulating varnishes, shellacs and compounds have been reflected in higher prices of the finished insulating materials. Prices of fibre boards are steady and stocks are good.

Outlet Boxes.—Heavy demand for 3-in. cable boxes has almost caused their disappearance from the market. The substitution of 3-in. outlet boxes for them has broken stocks in that line. Prices are those ruling at time of shipment. Raw material has advanced so that higher prices on boxes are expected.

Heating Appliances.—Westinghouse 6-lb. iron manufacture has been discontinued, and for it has been substituted a 6½-lb. iron for domestic use, listing at $8.50. This change became effective Jan. 16. The 6-lb. iron stocks will be sold till exhausted.

Cords.—Lamp-cord prices are about 5 per cent higher, as of Jan. 26, and shipping dates are very long. Factories are far behind on heater cord and are not anxious for new business. Asbestos for the latter is short.

Magnet Wire.—Extremely heavy demand is so taxing mill capacity that prices are about 5 per cent higher in an attempt to discourage orders.

Rigid Conduit.—Under extremely low supply some jobbers' prices are a little higher. Prices of ½-in. black are around $85 for less than 1,000 ft., while for 1,000 ft. they are graded below $85 and as low as $75 in one case. Galvanized pipe is available in slightly better quantities than the black.

Fiber Conduit.—Recent heavy demands from central stations have reduced stocks considerably. Shipments are along a normal schedule, but stocks are not likely to hold out over a period of long-protracted buying.

Flexible Armored Conductor.—Supplies of raw steel and iron into the steel-strip mills are slightly decreasing so no better supply of finished conductor need be expected for some time. Steel prices over the second quarter are higher but are not yet reflected in the finished product. No. 14 double strip can be had for $88 in 1,000-ft. lots up to $105 in less than coil lots.

Wire.—Rubber-covered base is still averaging about 28 cents. Jobbers' stocks are good under satisfactory incoming shipments. The lowest price is $11.40 in large lots, running up to $12.50 and $13 for 1,000-ft. lots. Weatherproof base is 28 cents, and bare wire is 22.25 cents.

CHICAGO

The week has shown a slight improvement in jobbers' stocks for the territory, although deliveries are still very uncertain in most lines. Washing-machine manufacturers have announced price increases, in one case of as much as $50, making the present list price $200. The wringer situation has become so acute that the president of one large company went East this week to see if anything could be done toward speeding up the wringer manufacturers. The production of flatirons during 1919 was 1,200,000, with one company producing 750,000 of this total. The small-motor production has now reached the astounding figure of 200,000 per month and the demand still exceeds the supply. The building slump in Chicago still continues. Building permits this week amounted to $600,000 as against a weekly average of $2,000,000 for the past ten years. Several important announcements have been made, among them being one by the Buick Motor Car Company of extensions to the Flint (Mich.) plant to cost approximately $7,500,000 and an additional $3,000,000 on an assembly plant in St. Louis.

Wire.—Stocks are somewhat better on rubber-covered, with base price still holding at 29 to 30 cents. No. 14 is quoted at $12.50 per 1,000 ft. in 5,000-ft. lots and at $11.25 to $11.75 per 1,000 ft. in 10,000-ft. lots. No. 12 is quoted at $17 per 1,000 ft. in 5,000-ft. lots. Base price on weatherproof remains at 28 cents for sizable orders and 30 cents on small lots. Sizes of weatherproof on which base price is effective now range from No. 4/0 to No. 10 solid, instead of No. 4/0 to No. 4. Magnet wire is very difficult to obtain, especially in smaller sizes.

Lamp Cord.—No. 18 cotton-covered, is quoted at $24.25 in 1,000-ft. lots. Stocks are somewhat spotty in cotton-covered with silk-covered cords practically impossible to obtain.

Washing Machines.—Several manufacturers have annouced increases this week, in one case as high as $50, making a new list price of $200. Deliveries are very uncertain, manufacturers being held up on account of the very acute wringer situation.

Rigid Conduit.—Stocks are very short and jobbers consider themselves lucky to get a car without regard to sizes. One-half-inch enameled is quoted at $80 to $81.50 per 1,000 ft.; ¾-in., $105 to $108 per 1,000 ft., and 1-in., $155 to $159 per 1,000 ft.

Non-Metallic Flexible Conduit.—This material is coming through somewhat stronger, but stocks have not been built up to any extent. Current quotations on ⅜-in. loom are $33 in 5,000-ft. lots, showing an increase of from $3 to $5 since the middle of December.

Metallic Flexible Conduit.—Stocks are short. List price on the ½-in. is $10 per 100 ft. with 5 per cent off in coil lots of 100 ft. and 10 per cent off in 1,000-ft. lots.

Snap Switches.—Stocks are getting somewhat better, but are still uncertain. The 5-amp. single-pole non-indicating switch is quoted at $22.40 per 100 in standard packages of 250, and the 5-amp. three-way at $38.40 per 100 in standard packages of 100.

Sockets.—The supply is somewhat better, but stocks are still spotty with ½-in. cap key sockets in lots of 500 quoted at $26.40 per 100. Pull sockets are $48 per 100 in lots of 250, and keyless are $24 per 100 in 500 lots.

Reflectors.—The National X-Ray Reflector Company has announced an advance of 10 per cent list to jobbers and an increase to consumers of 50 per cent, in some cases, on direct-lighting equipment, and has reduced discounts from 27 to 20 per cent, making an increase of about 10 per cent on indirect reflectors. The glassware situation is reported as responsible for these increases.

BOSTON

Trade continues to put a heavy strain upon stocks and manufacturing facilities. Deliveries are lengthening, and a limited freight embargo on East-bound shipments has been declared by the New Haven and Central New England roads. Heavy snow is also retarding local deliveries. Collections are fairly good, although shortages in wiring materials are holding back the completion of wiring jobs and slowing down payments to and by contractor-dealers. Prices are steadier this week, but stocks are irregular and hard to maintain. Labor conditions are more stable. Building and engineering contracts to Jan. 22 total $13,677,000, against $3,643,000 for the same period last year. Office and industrial plant buildings are the chief features of this tremendous expansion. Central stations are making inquiries for distribution system equipment, and industrial plant activity is a feature of the cable market. Retail sales of appliances are holding up well, although some stores which were largely "cleaned out" at Christmas report dull trade this month. Jobbers are still buying far ahead, but the manufacturers are beginning to make an impression on commodity stocks, and there is an undercurrent feeling that the worst shortages are past in most lines.

Wire and Cable.—Prices are unstable, discounts from base quotations varying widely. Roughly, bases range around 28 to 30 cents for rubber-covered and weatherproof, bare being quoted on 24 cents base. Heavy buying of cable by Middle West central stations featured the market last week.

Non-Metallic Flexible Conduit.—Stocks are still low. Quotations on ⅜-in. and ½-in. conduit in coil to 1,000-ft. lots are $34 and $37 per 1,000 ft. respectively. A large demand exists and contractors are complaining that important house-wiring jobs are delayed by the prevailing shortage.

Metallic Flexible Conduit.—A price of 15 per cent off list is noted on coil to 1,000-ft. lots. One-half-inch conduit is bringing $8.50 net per 100 ft., with many inquiries and low stocks.

Flexible Armored Conductor.—This material is scarce. Prices are firm, No. 14 single-strip bringing $90 per 1,000 ft. in coil to 1,000-ft. lots and $100 per 1,000 ft. in. less than coil lots. No let-up in demand can be seen.

Sockets.—Fair stocks are being maintained, although building expansion predicates no material surplus. Pulls in case lots are quoted 47.5 cents each, keys 27 cents and keyless 25 cents.

Snap Switches.—A good supply is reported, with steady prices. Discounts run from 17 to 20 per cent off list.

Motors.—Manufacturers and dealers are swamped with orders. Prices are firm. Sales of motors in fractional horse power sizes are very active and a brisk demand extends even to 25-hp. and 50-hp. units.

Transformers.—Central stations are coming into the market for extension and industrial equipment. One Boston jobber had nearly $100,000 in transformer bids out at the end of last week.

Appliances.—Grills and irons are beginning to come from the factories, but in moderate quantities. Toasters are scarce. Retailers are being urged to schedule their orders

on a basis of monthly shipments. Early fan shipments are about due on purchases made last fall. Washers and cleaners continue to flow in bulk into the retail market. Oblong grills are reported short, together with waffle-irons.

Ranges.—A fair demand exists, but deliveries are slow.

Industrial Electric Trucks.—Sales are steady if not rushing. Deliveries are longer, four to six weeks being quoted. Motor shortages appear responsible.

Fuses.—Trade is increasing. Stocks are still fairly full, but the future is likely to see a reduced quantity on hand. Forty-two per cent off list is quoted in ordinary cases.

ATLANTA

A constantly increasing demand for nearly all lines of electrical material is becoming more and more pronounced. Considerable difficulty in obtaining sufficient material is to be noted, and some of the jobbing firms reflect a feeling of uneasiness regarding the continued supply of the necessary commodities in their lines. As a result, orders are being placed anywhere that the material is to be obtained. The coming few months will witness the peak of the demand and every effort is being made to accumulate, if possible, sufficient stocks to supply in a measure at least the requirements of the trade. Slow shipments coupled with heavy demands indicate that this attempt to stock up for spring trade will not meet with much success. A number of jobbers are refusing to "back-order" any material.

Each week brings the announcement of the construction of a large number of new plants throughout the territory, while the chambers of commerce of the various cities are stressing the urgent need of additional housing facilities. Of course this activity is reflected in the tremendous increase in building permits for this section.

Conduit.—One of the largest jobbers reports an acute shortage in the larger sizes of rigid conduit, while a general shortage of the more popular sizes from ½-in. to 1½-in. is reported by all. Shipments continue poor, because of the inability of manufacturers to obtain raw material in sufficient quantities. Prices remain subject to quotations at date of shipment.

Safety Switches.—The recent ruling of the local electrical superintendent stimulates the demand, and while stocks are at present in fair shape, they cannot be expected to hold up for any length of time because of poor shipments.

Panelboards.—Contrary to the general rule, shipments on panelboards continue good. Brisk demands are being experienced, traceable largely to apartment house and office building construction.

Steel Boxes.—Despite a demand that is reported as only fair, a pronounced scarcity of steel boxes exists. Poor shipments show the impossibility of remedying this condition.

Printing-Press Motor Equpiment.—Inability of the manufacturer to supply the fall and winter demands is responsible for the slight slackening in the receipt of orders for this eqiupment. Continued poor shipments, which are quoted at twenty weeks, preclude the possibility of an accumulation of stocks in the territory. One of the largest jobbers reports his Atlanta stock entirely wiped out.

Heating Devices.—An increase in prices in all lines of heating devices has been announced, the increase varying from 10 to 20 per cent. Such an advance does not seem to have in any way checked the demand. Shipments are coming in but are being quickly absorbed by the retail trade.

Farm-Lighting Outfits.—One of the largest jobbers reports a growing tendency of the consumer to purchase outfits of the separate unit type. A brisk demand has depleted the local stocks and shipments are slow.

Industrial Motors.—A brisk demand for motors continues, particularly in the popular sizes of 220-volts and 2,300-volts. One of the national manufacturers announces an advance of from 5 to 10 per cent in all motor prices, effective Jan. 23. Stocks throughout the territory are badly depleted, with the popular sizes almost unobtainable. Shipments continue poor, the average at the present time being eighteen weeks.

SEATTLE—PORTLAND

Conservatively speaking, according to a majority of jobbers in the Puget Sound district, business is quiet; if anything, the sales are less and of smaller consequence than during any January for several years. This is attributed to increasing lack of employment, to closing down of shipyards, lumber mills and logging camps and because of general prevailing uncertainty. With the exception of sales of domestic appliances and some scheduled materials nothing is moving with any unusual momentum. Jobbers are taking inventory and trying to replenish and build up stocks.

Appliances.—Stocks of washing machines are low, but supply of vacuum cleaners and sewing machines is adequate, although both are showing a fair movement. Other appliance stocks are in fair shape, because jobbers ordered far in excess of actual needs. Prices are holding firm.

Lamps.—Lamp business during the past month shows a slight decrease over the previous month because of continued slacking off in building and decreased buying from ship yards and allied industrials. However, according to two jobbing houses, indications are that 1920 will be as good as last year or the year previous. Stocks are in good shape on account of execellent factory shipments from California.

Farm-Lighting Plants.—Sales are exceeding expectations; in fact, jobbers are having a hard time supplying the increasing demand from eastern and central Washington and Oregon. Sales in Puget Sound territory also have been far heavier than anticipated. Stocks are low but prices remain stable.

Motors.—Movement in power apparatus, including large motors, is at a minimum, but movement of smaller fractional sizes recently has shown a fair increase.

SAN FRANCISCO

A leading power company reports that 80 per cent of its power at the present time is steam power, a startling situation in a state noted for its hydro-electric service. Rainfall is light. The fine weather has stimulated building and many small jobs have been reported. One of San Francisco's largest department stores, which carries electric devices, has recently promulgated a radical decision, namely, to bill out all devices at the retail prices prevailing during date of actual purchase by the department stores. This plan has not had time to mature, so that its effects cannot yet be estimated.

Bells and Buzzers.—The great increase of small building has caused a sudden jump in the sales of bells and buzzers. Several San Francisco jobbers are now out of style C. The 2½-in. size nonadjustable now sells for 40.5 cents each in hundred lots. Buzzers in the same quantity sell for the same price.

Inclosed Fuses and Cut-Outs.—National code fuses and cuts-outs have increased 10 per cent in price in all quantities, the 250-volt size fuses in small quantities selling for 13.5 cents each in package lots. The demand for these fuses is increasing, and the call for renewable fuses, save from a few large plants that have installed cases and now wish links, has fallen to a mere trifle.

Vibrators.—The usual winter cold, and especially the heavy land fogs, has increased the sale of vibrators and heating pads. Side by side with this residential demand has grown a greater call for barber-shop and hotel installations of larger styles.

Porcelain Material.—Commercial porcelain, such as tubes and knobs, is selling at a surprising rate. Several orders of from 10,000 to 30,000 assorted pieces are reported in San Francisco, and such cities as Fresno and San José are ordering in lots of ten barrels. No. 5½ solid knobs are selling at $15 per barrel in barrel lots, ⅝-in. x 3-in. tubes at $9.45 per 1,000 in barrel lots. The demand for cleats is not so good.

Sewing Machines.—Portable electric sewing machines are soaring higher and higher. The vibrating style now sells at $62 each and the rotary style full-head motor at $74 each, with about a 33⅓ per cent margin to the dealer.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Coilless Electric Faucet Water Heater

An automatic electric faucet water heater which has no switch or coils is now being marketed by the "Hotwat" Distributing Company, 402 Title Insurance Building, Los Angeles, Cal.

The new faucet has but four major parts—the portion which is attached

AUTOMATIC ELECTRIC FAUCET WATER HEATER OF SIMPLE DESIGN

to the water pipe, a carbon cylinder, a graphite rod and a nickel cap. By turning the handle to the "hot" mark fresh cold water is said to be instantly heated by flowing into the upper part of the faucet. The faucet can be obtained with either a 4-in (10 cm.) or a 6-in. (15 cm.) heating cap and for operation with 110 volts or 220 volts, alternating current.

Multi-Cell Dry Battery

Standard-size dry cells insulated from each other and hermetically sealed in one container make up the "Red Seal

MULTI-CELL DRY BATTERY

sparker." Only the terminal nuts project through the sealing compound. These nuts are plainly marked positive and negative and are covered with an insulating knob which is easy to handle and prevents accidental short circuit by metal objects laid across the top of the battery. A web handle is fixed on the battery for convenience in handling. The "sparker" is regularly made in combinations of four to ten cells and may be had in special sizes.

Machine for Boiling, Washing, Rinsing and Drying Clothes

An electrically operated washing machine which boils, washes, rinses and dries clothes without the use of a wringer and without any necessity for handling or removing the clothes from the machine has been developed by the Home Utilities Company of Chicago and is known as the "Klymas."

Washing is done in the new machine by the vacuum and suction principle,

WASHES, BOILS, RINSES AND DRIES CLOTHES WITHOUT REMOVING THEM FROM MACHINE

three cups being used. A gas heater is provided so that boiling or steaming takes place and sterilizes the clothes while they are being washed. To rinse the clothes a faucet is first opened and the soapy water runs into a reservoir below the washing compartment. The fresh clean water is then turned on and the clothes are rinsed by the machine, the rinse water running off into the drain. Centrifugal force is used to dry the clothes. In cases where it is advisable to use the soapy water over again for the next batch of clothes it may be pumped back into the washing compartment free from dirt and foreign substances.

The new washing machine is operated by a ¼-hp. electric motor taking current from a lamp socket. Belt drive is employed and all moving parts are incased. The machine is constructed entirely of metal, aluminum, copper and brass being used for all parts coming in contact with water or the clothes. The capacity of the washer is eight sheets or their equivalent, and it is 26 in. in diameter and 42 in. high.

Splash-Proof Fractional Horsepower Induction Motors

A new line of fractional-horsepower induction motors has been brought out by the Ohio Electric & Controller Company, 5,900 Maurice Avenue, Cleveland, and are made in two frames and four ratings from ⅛ hp. to ½ hp. The housings are of the protected splash-proof type. A centrifugal cut-out starting switch is employed. The motors are

MADE IN TWO FRAMES AND FOUR RATINGS FOR ⅛ HP. TO ½ HP.

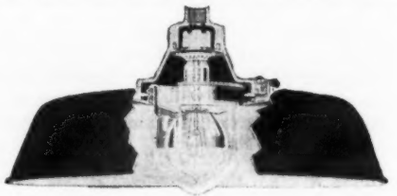
ball-bearing and are provided with a ventilating fan.

Standard specifications include pulley, detachable base with slotted holes allowing adjustment in mounting, and cord and plug. Direct-current motors of the same ratings and physically interchangeable with the induction motors are being developed.

Diffusing Industrial Lighting Fixture

High efficiency combined with uniform light distribution and low intrinsic brilliancy devoid of annoyance to the eye were the advantages sought for in designing the new "Maxolite diffuser," which is being offered by the Central Electric Company of Chicago.

The glass globe of the new lighting unit is 5 in. (127 mm.) in diameter and has its lower part frosted. The



DIFFUSES SHADOWS; PREVENTS GLARE

22-in. (55.8-cm.) enameled-steel reflecting shade, because of its large size, it is claimed, tends to eliminate and soften shadows and its curvature is designed to do away with glare. A

deflector plate is fitted closely around the neck of the lamp to prevent loss of light in the top of the fixture. There are said to be no parts of the lighted surfaces which can collect dust and the reflector and globe are easily accessible to a duster.

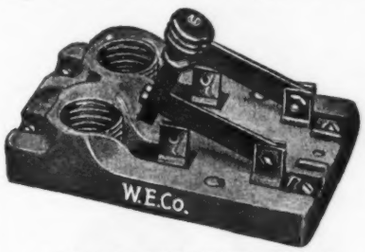
The new unit is recommended for use with a 200-watt gas-filled lamp, with 9 ft. (2.7 mm.) to 14 ft. (4.2 m.) spacing, mounted at a height of from 11 ft. (3.3 m.) to 14 ft. (4.2 m.). A unit for use with 100-watt or 150-watt lamps is also manufactured.

Insulated Danger Signs

Insulated danger signs made of asbestos slate and bearing the legend "Danger, —— Volts" in white on a red background are now made by C. B. Hughes, 7010 South Green Street, Chicago. These signs are said to be especially useful for hanging over transformers and other "live" equipment since should they fall down they will not cause a short circuit.

Two-Pole and Three-Pole Entrance Switches

Porcelain-base entrance switches in two-pole and three-pole styles are now



TWO-POLE ENTRANCE SWITCH

being manufactured by the Ward Electric Company, Philadelphia Stock Exchange Building, Philadelphia, Pa.

Electrically Operated Railroad Crossing Signal

The Charles Adler Electric Brake Company, 1718 Eutaw Place, Baltimore, Md., has developed a safety railroad-crossing signal consisting of an audible alarm for warning vehicles of a train's approach and a railway-side visual signal to indicate to the engineer as his train enters the block whether or not the audible alarm or bell at the crossing some 1,200 ft. (365 m.) ahead is ringing. When the bell is out of order and does not ring it signals the engineer of the approaching train so that he may sound the locomotive bell and approach the crossing at slow speed.

Tree Trimmer Has Two Speeds

A distinctive feature of a new tree trimmer designed by the Bush Electric Company, 6,654 Broadway, Cleveland, Ohio, is the high and low gear at which it operates. One quick sliding motion of the handle, it is claimed, gives plenty of leverage for cutting small branches. For larger limbs the operating handle is swung around, giving a greater leverage for operating the cutter. It is said that with three or four pulls a limb 1¾ in. in diameter may be cut.

The wooden handle is specially treated to withstand 5,000 volts per inch. There are no ropes, wires or metallic connections between the cutter and the operating handle.

Rug Display Fixture

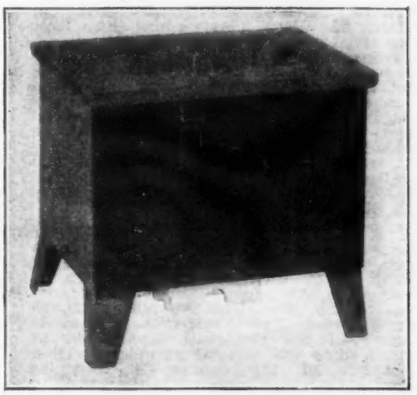
For illuminating rugs on display the Pittsburgh Reflector & Illuminating company has developed a fixture for mounting four or five lamps in reflectors directly in front of the rugs. The

MAY BE MOUNTED ON CEILING OR ON PIPE HANGERS

frame, which is of square steel tubing, black enamelled inside and out, is either mounted directly on the ceiling or carried on pipe hangers dropped from the ceiling. The lamp receptacles are mounted on the bottom side of this tube, and the wires are run inside of the tube. A pull switch with a cord is furnished. The fixtures are in two standard lengths one for four lamps and one for five lamps, and are in two types to accommodate either 50-watt or 100-watt lamps as desired.

Bench Type Metal Melter

For melting lead, babbitt and similar metals what is known as the 25-lb. electric metal melter bench-type pot has been developed by the General Electric Company, Schenectady, N. Y. This new pot is of solid, durable construction, having four short legs on the bottom and a flange on the upper rim and has plug and socket fixture.



AUTOMATIC REGULATION OBTAINED BY USING WIRE WITH POSITIVE TEMPERATURE COEFFICIENT

The automatic regulation which is the principal feature of the device has been obtained by constructing the heating element of wire which has a positive temperature coefficient. When cold metal is put into the container the initial rise of current is enough to melt it quickly, but after it is melted the current is automatically reduced to just enough to keep it molten but not enough to burn it.

Helmet, Apron and Gloves for Electric Welding Operators

A protecting helmet shields and an apron and gloves treated with a fire-resistant compound have been brought out by the Electric Arc Cutting and Welding Company, 222 Halsey Street, Newark, N. J., for the use of electric welding operators.

Weatherproof Quick-Make-and-Break Safety Switches

A heavy cast-iron externally operated outdoor safety switch with rain-proof cover has been brought out by the V. V. Fittings Company, 1910 North Sixth Street, Philadelphia, and is designed with safety features to give maximum protection to the operator and to the circuit which the switch controls.

The cast-iron box of the new switch has fastening lugs on the outside to insure rigidity and a weatherproof installation. The switch mechanism is the same as that of the type BG

switches made by this company and described in the ELECTRICAL WORLD of Jan. 24, 1920. These switches are obtainable in fusible style for N.E.C. fuses and for operation on alternating current or direct current of 250 volts. Either 30-amp. or 60-amp. sizes may be had in two-pole or three-pole styles.

Notes on Recent Appliances

Tension Device for Coil Winding

For use in high-speed coil winding the Belden Manufacturing Company, Twenty-third Street and Western Avenue, Chicago, has developed a tension device.

Motor-Driven Deep-Well Pump

The Burnett-Larsh Manufacturing Company, 537 East Monument Avenue, Dayton, Ohio, has recently brought out its style No. 3000 "Duro" electrically driven directly connected deep-well pump.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

I. F. BAKER of the Westinghouse Electric International Company, who has been in the New York office of that company for the past two years, is on his way to Tokio, Japan, where he will act as a special representative of the Westinghouse Electrical International Company.

R. M. MURPHY, recently made sales manager of the McCandless Miniature Lamp Works of the Westinghouse Lamp Company, commenced his electrical career with Sanderson & Porter, engineers, Jan. 1, 1906. On Jan. 1, 1909, he went into the employ of the Westinghouse Electric & Manufacturing Company at San Francisco, leaving the company in 1912 to manage the Los Angeles office of the Westinghouse Lamp Company. He returned in 1915 to San Francisco to handle general sales work for the company on the Pacific Coast. In 1917 he was transferred to the New York executive offices as manager of the company's syndicate activities. On Jan.

R. W. MURPHY

1, 1919, he was appointed assistant sales manager of H. W. McCandless & Company, a subsidiary of the Westinghouse Lamp Company, the sales departments of which were later more closely merged into the sales organization of the Westinghouse Lamp Company, after which consolidation he was made sales manager of the McCandless Miniature Lamp Works of the Westinghouse Lamp Company.

THE UNITED STATES LIGHT & HEAT CORPORATION, Niagara Falls, N. Y., has plans under consideration for the rebuilding of the battery building recently destroyed by fire.

THE EDISON ELECTRIC APPLIANCE COMPANY'S New York office will move from 147 Waverley Place to 140-142 Sixth Ave. between Tenth and Eleventh Streets, about Feb. 1. The new location will provide ample space for offices, showrooms and service station.

GEORGE M. CULLINANE, who, as assistant works engineer had charge of electrical design and construction of new plants for the Scullin Steel Company, St. Louis, Mo., resigned Jan. 1. 1920, to become sales engineer in the St. Louis office of the Westinghouse Electric & Manufacturing Company. Mr. Cullinane was graduated from the University of Illinois in 1917.

FUSE COMPANY BUYS EAST ST. LOUIS PLANT.—The Bussmann Manufacturing Company has completed the purchase of a modern factory in East St. Louis totaling 22,000 sq.ft. of floor space, according to a statement issued by Harry Bussmann, vice-president of the company. The new factory will be operated as plant No. 2 and will double the capacity of the Bussmann company, which manufactures electrical fuses of all types. Its sales in 1919 amounted to 16,000,000 fuses, and the 1920 production is based on an estimated output of 40,000,000. Additional ground adjoining the new plant has been acquired by the company, sufficient to permit an increase of 50,000 sq.ft. of floor space when it becomes necessary. Further enlargements are expected in the next eighteen months, and a capacity of 75,000,000 fuses a year will be attained in two years, according to present plans.

CHARLES CORY & SON, INC., 290 Hudson St., New York City, manufacturer of electrical signaling apparatus, electrical marine equipment, etc., is rushing work on the construction of its new plant at 183-187 Varick St., upon completion of which the company's works will be removed to the new location. The plant should be in operation by May.

THE CRESCENT INSULATED WIRE & CABLE COMPANY, Trenton, N. J., has completed plans for the construction of a new addition to its plant, one-story steel and concrete, about 50 ft. x 125 ft., to be built on property acquired recently at Taylor St. and Ginder Alley. The structure is estimated to cost about $40,000.

THE GENERAL ELECTRIC COMPANY has completed plans for the early construction of a large new three-story brick addition about 67 ft. x 196 ft., to its Windsor (Conn.) plant.

THE INCANDESCENT SUPPLY COMPANY, 468 West Broadway, New York City, has filed notice with the Secretary of State of an increase in capital from $250,000 to $500,000.

THE INDEPENDENT LAMP & WIRE WORKS, Weekhawken, N. J., has awarded a contract for the erection of a new building on Gregory Ave., to be used as an extension to its present works.

A. C. MANWEILER COMPANY, Fort Wayne, Ind., manufacturer of incandescent lamps, etc., suffered a loss of more than $10,000 in a fire which occurred in its factory on Jan. 3. So much of the machinery was destroyed that the plant had to be shut down, but Mr. Manweiler told a representative of the ELECTRICAL WORLD that he expected to resume the operation of the factory at an early date.

THE MATERIAL HANDLING MACHINERY MANUFACTURERS' ASSOCIATION, 35 West Thirty-ninth St., New York City, has changed the date of its meeting from Jan. 29-30 to Feb. 26-27. The sessions will be held at the Waldorf-Astoria Hotel, and the association invites to them all manufacturers of cranes of various types, hoists, winches, conveyors, industrial trucks, tractors and trailers, bulk-handling machinery, elevators and all forms of equipment and supplies used in construction and operation of mechanical handling machinery. Zenas W. Carter, 35 West Thirty-ninth St., is secretary.

L. S. MONTGOMERY, who joined the organization of the Fairbanks Company in March, 1918, as manager of the electrical department of that company's branch at Birmingham, Ala., has recently been transferred to the administrative offices at 416 Broome Street, New York City, and made manager of the electrical department of the mill, mine and railway supplies division in charge of the company's activities through its various branches in the handling of industrial electrical supplies. At Birmingham Mr. Montgomery organized the first electrical supply department for the company. The success of that department has caused the company to decide on the addition of similar departments to all its twenty-two branches. Those at New Orleans, St. Louis and Baltimore will take up this work first. It is the plan to specialize in industrial electrical supplies. It will be the aim to stock standard lines sufficient to meet all requirements of light and power installations. Mr. Montgomery's varied and successful experience in the organizing of electrical sales work makes him especially fitted to direct the policies of the Fairbanks Company in its new undertaking. Eleven years ago he was made district manager of the National Metal Molding Company and established that company's first office in the South at Atlanta, Ga. Four years later, in March 1913, he was transferred to organize a district office in Pittsburgh, Pa. A little later he was transferred to Buffalo as district manager in charge of the Canadian territory. After three years in that position he resigned to do military service on the Texas border as a member of the National Guard. When discharged he was appointed manager of the New York office and warehouse of the American Conduit Manufacturing Company, which position he held until the declaration of war with Germany. Mr. Montgomery served in the army with the rank of captain. He joined the organization of the Fairbanks Company shortly after being released from the service last year.

THE LOCKE INSULATOR MANUFACTURING COMPANY, Victor, N. Y., announces that, as of Jan. 1, Kent A. Hawley will have charge of the company's New York City office, at 233 Broadway. Mr. Hawley is a graduate of the University of California and has been connected since 1907 with the following firms and projects: Simmen Automatic Railway Signal Company, of Los Angeles; Charles C. Moore & Co., on the test of the Redondo power plant of the Pacific Light & Power Company; Great Western Power Company, on the construction of the Great Bend power plant with Vielé, Blackwell & Buck, engineers; design and construction of the Oakland substation and auxiliary power plant, and the construction of the generating and substations of the Appalachian Power Company. He was with the construction department of the General Electric Company at the McCall's Ferry power plant of the Pennsylvania Water & Power Company, and with Gibbs & Hill of New York on the electrification of the Norfolk & Western Elkhorn grade, the Pennsylvania Railroad at Philadelphia, the New York Connecting Railroad on Long Island, and recently on the electrified zone of the New York, New Haven & Hartford Railroad.

K. A. HAWLEY

GEORGE N. BROWN, before entering service in 1916 an electrical engineer and later assistant superintendent for the New York State Railways Syracuse-Utica lines in Utica, on his return as captain of engineers last July, again became connected with the railway company. In September he became manager of the Buffalo office, 601 Ellicott Square, of the Schiefer Electric Company, Rochester, N. Y. E. E. Strong, formerly superintendent of the Rochester lines of the same railway, is manager of the Schiefer Syracuse office.

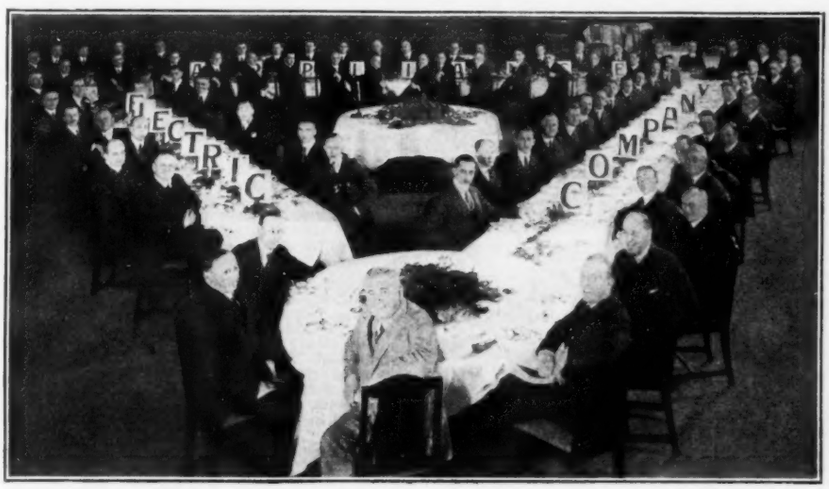
THE DOEHLER DIE-CASTING COMPANY, Brooklyn, N. Y., at its Jan. 5 directors' meeting, re-elected the following officers: H. H. Doehler, president; H. B. Griffin, vice-president; O. A. Schroeder, treasurer; O. A. Lewis, assistant secretary. The company also added to its list of officers J. Kralund, second vice-president, in charge of production, and Charles Pack, secretary and chief chemist.

THE BLACK & DECKER MANUFACTURING COMPANY has further extended its permanent organization by the establishment of a branch office at 6523 Euclid Avenue, Cleveland, Ohio. Garth A. Dodge, formerly connected with the Austin Company at its Cleveland headquarters, has recently joined forces with Black & Decker in the capacity of branch manager for the states of Ohio and Indiana and will be in charge of the Cleveland branch.

Supply Jobbers' Notes

CLARENCE L. ELDER has been appointed general sales manager of the Varney Electric Supply Company, Indianapolis, Ind. Mr. Elder has been with this company for about ten years and was first assistant manager in the sales department at the time of his promotion on Nov. 1.

THE ELECTRIC APPLIANCE COMPANY of San Francisco opened the new year with an annual dinner, to which the representatives of the manufacturers with which the company does its principal business were invited. The toastmaster, C. C. Hillis, vice-president and general manager, emphasized the value to both the company and the employees of maintaining the closest personal touch with the trade. The banquet tables were arranged in triangular form to symbolize the trademark of the company.



MEMBERS AND GUESTS OF ELECTRIC APPLIANCE COMPANY AT ANNUAL DINNER

J. LIVINGSTON & COMPANY, INC., New York City, is organizing a new company which will be known as the Livingston Sales Corporation, capitalized at $100,000. This company will take over the electrical appliance business of J. Livingston & Company and will sell through dealers exclusively in all territory where it has a dealer representation. The latest contract is with the Kelvinator Corporation of Detroit for the distribution of its household refrigerating machines for the Metropolitan district, eastern part of the State of New York, northern part of New Jersey, Long Island, Staten Island and a portion of Connecticut. The company has undertaken to sell upward of 1,700 of these machines during the year 1920 and anticipates that this quantity will not be sufficient to supply the demand. The company distributes nine different lines of household labor-saving devices.

Foreign Trade Notes

CONDUIT AND CABLE URGENTLY NEEDED IN SOUTH AFRICA.—According to the South African Mining and Engineering Journal, the present dearth of threaded tubing for underground use, is of immediate concern in the electrical world of Johannesburg. In lieu thereof contractors are being forced to use water piping. Other materials are coming in fairly freely. The supply of heavy cables is short, and there are only small shipments of electrical goods on the water in transit to South Africa, it is said, but it is generally expected that in the near future heavy consignments will be dumped there from Germany at prices much below English, American, and Japanese goods. As a mater of fact, goods bearing the trade mark "made in Holland" have already arrived.

GROWING DEMAND FOR ELECTRICAL SUPPLIES IN COLOMBIA—As a result of the large coffee crop of the last season and the high prices obtained for its export, the city of Manizales is now an excellent market for foreign goods, especially American. The largest part of the coffee crop of this vicinity is marketed in the United States and local merchants have therefore a large amount of funds located in New York with which to purchase American manufactured articles. All sorts of manufactured articles are in demand, but it is especially noteworthy that electrical supplies are coming into use.

DEVELOPMENT OF THE SWEDISH ELECTRICAL INDUSTRY.—According to the Electrical Industry Association of Sweden, the Swedish electrical industry has made splendid progress during the years of the war. The combined share-capital of Swedish electrical industries, which amounted to about 50,000 kr. in 1914, has at the present time reached a total of 230,000 kr. The total output-value of the trade was about 20,000 kr. in 1914 and would seem to have come to about 100,000 kr. in 1918. However, the Swedish electrical industry must be prepared to meet a much keener competition after the war both in the export and in the home market, according to the Association report.

FRANCE NEEDS ELECTRICAL SUPPLIES.—There is a certain demand for imported supply material in France. At the same time French manufacturers are increasing their output of electrical goods. Conduit is scarce, a conduit made of tumbler sheet metal tube with crimped joints lined with paper being substituted. This uses sleeve unions instead of screwed joints. This type is preferred to heavy metal conduit. Screw sockets rather than bayonet sockets are needed, and other inquires call for multiple snap switches, flush type push-button switches, fittings requiring hard rubber in their manufacture and high candle-power low-volt moving picture lamps.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

M. H. Dinshaw & Company, Green Street, Fort, Bombay, India, importers and dealers in machinery and electrical products such as generators, motors, nevelties, etc., requests catalogues, price lists with discounts and any other information from manufacturers of such apparatus, with a view to representing them in India.

A company in the Canary Islands (No. 31452) desires to secure an agency for the sale of electric material. Quotations should be given c. i. f. the Canaries, via Liverpool. Terms 30 days sight up to 60 days usually granted to purchasers. Correspondence should be in Spanish.

An engineer in the United States (No. 31464) who is about to make a visit to Venezuela and Porto Rico, desires to secure the representation of firms for the sale in those countries of electrical apparatus, power plants, and anything in connection with the electrical trade.

Trade Publications

OUTDOOR DISCONNECTING SWITCHES.—Hickey & Schneider, Inc., 439 East Jersey Street, Elizabeth, N. J., have just published Bulletin No. 15 on their various types of disconnecting switches for outdoor service.

MEASURING GASES.—The Bacharach Industrial Instrument Company of Pittsburgh, Pa., has issued pamphlet leaflet on Pitot tubes and orifices for measuring the flow of gases in connection with flow meters.

BATTERY CHARGER. — The France manufacturing Company, West 104th Street and Berea Road, Cleveland, O., is circulating bulletin No. 31 on the "F. F. Bantam Battery Booster" for home charging of storage batteries.

RADIATORS. — The Majestic Electric Development Company 1702 Allegheny Avenue, Philadelphia, Pa., has prepared a leaflet descriptive of its No. 8 radiant electric heater which has two heating units.

INSTRUMENTS.—A forty-page booklet has been issued by the Pyrolectric Instrument Company, 636 East State Street, Trenton, N. J. covering "pyrovolter" type instruments and thermocouples.

INDUSTRIAL TRUCKS AND TRACTORS.—A forty-eight page booklet has been prepared by the Automatic Transportation Company of Buffalo, N. Y., to tell about its "Automatic" electric industrial trucks, tractors and engines.

FLOOR MACHINE.—The International Floor Machine Company, 149 West Thirty-sixth Street, New York City, is circulating a folder about the "International" electrically operated floor polishing and surfacing machine.

JACKS.—Templeton, Kenly & Company, Ltd., Central Avenue, Taylor and Fillmore Streets, Chicago, have issued a circular announcing a new model automatic raising and lowering pole-pulling and pole-straightening jack.

PANELBOARDS AND CABINETS. — Safety panelboards and cabinets are covered in Bulletin No. 47,942 recently issued by the Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York City.

CARPET WASHER.—The International Floor Machine Company, 149 West Thirty-sixth Street, New York City, has prepared a card describing and illustrating its "International" electrically driven carpet washer.

FARM-LIGHTING PLANTS. — The A-C Electrical Manufacturing Company of Dayton, Ohio, has issued a booklet covering "Dayton" country home-lighting systems, dynamos, batteries, switchboards, etc.

New Incorporations

THE GAIR REALTY CORPORATION of Brooklyn, N. Y., has been incorporated by R. Gair, 120 New York Avenue; G. Gair, 37 Pierrepont Street, Brooklyn, and R. Gair, Jr., Glen Cove, N. Y. The company is capitalized at $150,000 and proposes to do a realty, construction, electric lighting and garage business.

A. H. GREBE & COMPANY of Richmond Hill, N. Y., has been incorporated with a capital stock of $50,000 to manufacture wireless and electric instruments. The incorporators are: A. H. Gregg, 10 Van Wyck Avenue, Richmond Hill; L. C. Pacent, Winfield, L. I., and D. Rigney, 5 East 119th Street, New York City.

WILLIAM H. RABELL ENTERPRISES, INC., of New York, N. Y., has been chartered by W. Rabell and C. H. Secor, 720 Seventh Avenue, and C. E. Rabell, 854 Riverside Drive, New York City. The company is capitalized at $100,000 and proposes to install automatic electric light plants.

THE SQUIRREL ISLAND (ME.) ELECTRIC COMPANY has been incorporated with a capital stock of $25,000 to do a general electric lighting business, operate telephone and telegraph systems, etc. The officers are: Frank I. Cowan, president; Clement F. Robinson, treasurer, and Robert T. Whitehouse, clerk, all of Portland, Me.

New England States

PORTSMOUTH, N. H.—Preparations are being made by the Rockingham County Light & Power Company for the hydro-electric power development on the Lamprey River in the Town of Durham.

SPRINGFIELD, MASS.—Bids, it is understood, will soon be asked by McClintock & Craig, engineers and architects, 33 Lyman Street, Springfield, for the construction of a large power house on Cold Springs Avenue for the Gilbert & Barker Manufacturing Company.

BRIDGEPORT, CONN.—Plans are being prepared by Wescott & Mapes, engineers, 207 Orange Street, New Haven, for the construction of a new power plant for the United Illuminating Company on Congress Street, to cost about $1,500,000.

LUNENBURG, VT.—Preliminary sketches have been made by C. F. Hardy, architect and engineer, 309 Broadway, New York, N. Y., for a power house for the Fitzdale (Vt.) Paper Mills in Lunenburg, to cost about $1,000,000.

Middle Atlantic States

BINGHAMTON, N. Y.—The Board of Supervisors of Broome County is considering the installation of a new electric light and power plant at the county farm.

ROUSES POINT, N. Y.—The installation of a new electric generating unit in the municipal electric light plant is under consideraton. H. A. Sabourin is manager.

SOLVAY, N. Y.—The Solvay Municipal Commission is contemplating increasing the capacity of power feeder lines to care for 300 additional hp. at Frazer & Jones Foundry. Charles H. Cross is superintendent.

UNION, N. Y.—The Board of Trustees is considering the erection of a transmission line to furnish electricity for street and commercial lighting in West Endicott. C. C. Clift is superintendent.

ATHENIA, N. J.—The Magor Car Company will soon call for bids for the construction of a new power house, to cost about $35,000. N. Schoonover, 31 Clinton Street, is engineer.

NEWARK, N. J.—Contract has been awarded by the Stanwood Rubber Company for the erection of a two-story power plant, 75 ft. x 84 ft., on Frelinghuysen Avenue near Virginia Street, to Charles Flocken, 681 Newark Avenue, Elizabeth.

CHAMBERSBURG, PA.—Plans are under consideration by the Borough Council for extensions and improvements to the municipal electric light plant.

DALTON, PA.—Plans are being prepared by the Scranton & Binghamton Railroad Company, 227 Wyoming Avenue, Scranton, for an addition to its local power house. New equipment, including three 500-hp. boilers and 15,000-volt electric generating units, will be installed. The cost is estimated at $95,000.

PHILADELPHIA, PA.—Plans have been prepared by the Department of Public Works for a new engine plant and pumping station at the Lardners Street waterworks plant.

SHARPSBURG, PA. — The installation of a condensor for one 300-kw. turbine in the municipal electric light plant is under consideration. W. C. Wetzel is superintendent.

VARDEN, PA.—The Varden & Lake Ariel Light, Heat & Power Company contemplates extensions to its transmission lines in the spring. W. W. Kizer is president.

MOUNT HOPE, W. VA.—The Mount Hope Electric Power & Water Company contemplates extending its transmission lines to two mines. George A. Waldo is president and manager.

WARRENTON, W. VA.—The Warrenton Electric Light & Power Company contemplates the installation of a 90-kw., 60-cycle, 2200-volt generator and a 150-hp. Erie boiler, the erection of 5 miles of transmission lines and a new series street-lighting system. M. J. O'Connell is secretary and manager.

BRIDGEWATER, VA.—The North River Electric Company is contemplating the installation of a new three-phase generator, increasing its water power, installing an auxiliary steam plant, and extending its transmission line to Mount Crawford, 2½ miles, and also building several mutual lines in the surrounding country. G. Richard Berlin is president and manager.

FREDERICKSBURG, VA.—The Rappahannock Electric Light & Power Company contemplates the installation of a 500-kva. steam turbine and boilers and rebuilding its distribution system. S. C. Foster is general superintendent.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

North Central States

COLDWATER, MICH. — Contract has been placed for a 1,000-kw. General Electric turbo-generator set for the municipal electric light plant, to be delivered April 1. About 10 miles of transmission lines into the country districts are under construction. L. E. McQueen is superintendent.

DETROIT, MICH.—Plans are being prepared by the Detroit Edison Company for the construction of a power plant on Bounce Creek in Marysville.

GRAND RAPIDS, MICH.—The Board of Education is planning to erect a high school on Plainfield Avenue, to include coal storage and power plants. H. H. Turner, 234 Division Avenue North, is architect.

GRAND RAPIDS, MICH.—The installation of an additional 1000-kw. Allis-Chalmers turbo-generator in the municipal electric light plant is under consideration. Gerald J. Wagner is director of public service.

BRADNER, OHIO.—The Board of Public Works is contemplating extending the transmission lines of the municipal electric lighting system into the country districts. W. B. McCormick is superintendent.

CLEVELAND, OHIO.—Plans are being prepared by S. W. Weis, architect, Schofield Building, Cleveland, for the erection of a large garage on East Seventy-ninth Street and Hough Avenue, for the Realty Syndicate, 309 Williamson Building, to cost about $400,000.

DOVER, OHIO.—Preparations are being made to replace the gas engines now in use in the municipal electric light plant with steam engines and to equip the waterworks pumping station for electrical operation this year. Plans are also under consideration to rebuild the entire transmission system this spring. Homer H. Keppler is general superintendent.

LEWISBURG, OHIO.—The Brookville-Lewisburg Lighting Company contemplates changing its system from single-phase to three-phase in Lewisburg and Brookville and also the erection of several rural lines. Karl A. Katzenberger is local superintendent.

NEW PHILADELPHIA, OHIO.—The Wise-McClung Manufacturing Company contemplates a number of extensions to its plant, including a building for assembling and storage, machine shop, power plant, addition to motor and assembling building, polishing department and addition to foundry. W. E. McClung is secretary and treasurer.

JACKSON, KY.—O. G. Gillum, owner of the local electric light plant, is contemplating the installation of a 25-hp. oil engine directly connected to a 20-kva., three-phase, 2300-volt generator.

MARLOW, KY.—The installation of an ornamental street-lighting system is under consideration by the Electric Light Department. E. Faulkner is superintendent.

MAYFIELD, KY.—The installation of a 300-kw. generator in the municipal electric light plant is under consideration.

ALBION, IND.—The construction of an entire new electric light plant is under consideration by the water and light department. Edwin M. Maloney is manager.

ATTICA, IND.—The municipal electric light and Water department is considering extending the municipal electric lighting service for rural subscribers and small towns, requiring the erection of about 15 miles of lines. B. H. Freeland is superintendent.

BERNE, IND.—The Berne Electric Company is contemplating securing energy from the municipal electric plant at Bluffton. Amos Hirschey is secretary.

CRAWFORDSVILLE, IND.—The Crawfordsville Electric Light & Power Company is contemplating the erection of a three-phase transmission line, 3 miles, to supply 900 hp. H. E. Hayworth is manager.

DECATUR, IND.—The installation of ornamental lamps in all parts of the city is under consideration. The city will supply electricity to maintain the lamps if the property owners will purchase them. The cost of the lamps is placed at $32 each.

BELLEVILLE, ILL.—The St. Clair County Gas & Electric Company contemplates the installation of a frequency changer. John R. Hoffman is local superintendent.

CASEY, ILL.—The erection of a 5-mile transmission line is under consideration by the municipal electric light department. J. C. Pfister is superintendent.

CASS CITY, ILL.—Plans are under consideration for improvements to the municipal electric light plant and waterworks system this spring, including the installation of a steam-driven generator (2,300-volt) and possibly a waterworks pump. W. N. Straube is manager.

CHICAGO, ILL.—The Stromberg Electric Company, 606 South Michigan Avenue, it is understood, will ask for bids early in the spring for the erection of its proposed new plant, consisting of a group of buildings at Wrightwood and Greenview Avenues, to cost with equipment about $500,000. The company manufactures electrical appliances, etc. Robert J. Newberry, 108 South La Salle Street, is architect.

GRAFTON, ILL.—At a special election held recently the proposal to establish a municipal electric lighting system was carried. Another election will probably be held to authorize bonds to finance the project.

ALGOMA, WIS.—The city water and light department is contemplating the purchase of energy from the Wisconsin Public Service Company of Green Bay. The proposed transmission line would be 63 miles long, 66,000 volts, three-phase, 60 cycles. E. P. McCarthy is superintendent.

AMERY, WIS.—The Apple River Milling Company contemplates the erection of 39 miles of 22,000-volt transmission line. The company is building hydro-electric development at Colfax, which when completed will furnish electricity for lamps and motors in Colfax and Wheeler. Contracts have been closed by the company to furnish electricty in Barnette, Shell Lake and Spooner, Wis. The service will be extended to these places during this year. W. R. Haney is superintendent.

BAGLEY, MINN.—The Water and Light Commission is contemplating the installation of transformers for motor load. G. M. Hanson is manager.

JACKSON, MINN.—The Council is considering extending the electric lines of the municipal electric plant to serve a small town and also the erection of farmer lines. This work may be done this year. J. E. Barrett is superintendent.

MAYNARD, MINN.—Some line extensions are contemplated to the municipal electric lighting system. L. A. Sanner is manager.

MIDDLE RIVER, MINN.—The Middle River Light & Power Company contemplates the installation of a new electric generating unit. Emil Peterson is owner and manager.

NEW PRAGUE, MINN.—The electric light and waterworks department contemplates the erection of new 250-volt direct-current lines. Joseph T. Rynda is manager.

TWIN VALLEY, MINN.—The J. F. Heiberg Electric & Power Company contemplates the installation of a 125-kw. generator, umbrella type, with a 28-in. wheel. The company is now erecting a three-phase transmission line (15 miles long) to Ulen. J. F. Heiberg is manager.

WACONIA, MINN.—The Waconia Light & Power Company contemplates the erection of about 20 miles of transmission lines into the farming district and 6 miles of 12,000-volt transmission line. E. F. Strong is president.

WILLMAR, MINN.—A new boiler will be installed in the municipal electric light and water works plant. N. W. Larson is superintendent.

DUBUQUE, IOWA. — The Eastern Iowa Electric Company is contemplating the erection of 10 miles of farm lines. F. K. Altman is manager.

EARLHAM, IOWA.—The Council is considering extensions to the rural lines of the municipal electric lighting system. M. A. Thorp is superintendent.

ELDRIDGE, IOWA.—The People's Light Company of Davenport is erecting an electric transmission line from Eldridge to Long Grove, a distance of 3 miles.

GALT, MO.—The Galt Light & Power Company is contemplating the erection of an electric transmission line from either Trenton or Brookfield to Galt. D. H. Clark is president.

LATHROP, MO.—The Lathrop Light, Heat & Power Company contemplates rebuilding part of its system. E. S. Grant is secretary and manager.

ODESSA, MO.—The municipal electric lighting system will be taken over by the Green Light & Power Company of Pleasant Hill within the next few months. Electricity for the local system will be supplied over a 23,000-volt transmission line, 35 miles long. The local distributing system will be changed from 220 volts, direct current, to 60 cycles, 110 volts, alternating current. J. G. Lightner is manager of the municipal plant.

PARMA, MO.—James McMullen, owner of the local electric light plant, contemplates the installation of a 50-hp. engine and a 35-kw. generator.

PATTONSBURG, MO.—The Pattonsburg Electric Light & Ice Company contemplates extending its electric transmission lines to Kidder, Jameson and McFall, Mo. The company has recently completed lines to Winston and Altamont, where it will supply electrical service. O. L. Wright is president.

RICHLAND, MO.—The Richland Light & Power Company is contemplating the installation of a 60-kw., three-phase generator and fuel-oil engine of 60-hp. or 75-hp. this summer. E. R. Woodward is president and manager.

ST. LOUIS, MO.—The Century Electric Company, 1827 Pine Street, contemplates the erection of an addition to its plant for the manufacture of electric motors.

ARCADIA, NEB.—The Arcadia Electric Light & Telephone Company expects to install a new 75-hp. oil engine this season. J. P. Wait is proprietor.

FAIRBURY, NEB.—The Board of Public Works is considering extensions to the municipal electric light plant, including the installation of a 400-kw. generating unit, directly connected and the erection of 6 miles of three-phase, 6600-volt transmission lines. G. D. Myers is manager.

HARVARD, NEB.—The Harvard Electric Company contemplates extensions to its power lines. J. E. Person is manager.

OAK, NEB.—The Meyer Hydro-Electric Power Company contemplates raising its dam and installing an additional oil engine and extensions to its transmission lines. Ernst Meyer is manager.

PLAINVIEW, NEB.—A 175-kw. electric generating unit, directly connected, will be installed in the municipal electric light and water plant. An ice-manufacturing plant is being installed in connection with the water and light plant. O. N. Michener is superintendent.

RAVENNA, NEB.—The Ravenna Light, Heat & Power Company contemplates some extension to its generating capacity. A. T. Shellenbarger is secretary and manager.

ATTICA, KAN.—The installation of a 100-hp. oil engine in the municipal electric light plant is under consideration. J. C. McCaddon is city clerk.

CLAY CENTRE, KAN.—The erection of 12 miles of transmission line is under consideration by the Public Utilities Commission. C. S. Callender is superintendent.

COFFEYVILLE, KAN.—The installation of two additional boilers 375-hp. and 500-hp., in the municipal water and light plant is under consideration. E. J. Walcott is superintendent.

GRENOLA, KAN.—The installation of a 75-kw. generator and a 100-hp. engine in the municipal electric light plant is under consideration. Edgar Robertson is manager.

HIAWATHA, KAN. — The Hiawatha Light, Power & Ice Company contemplates the installation of a 365-hp. Diesel engine. R. H. Love is secretary and manager.

HUTCHINSON, KAN. — The United Water, Gas & Electric Company contemplates the installation of two 1,000-hp. boilers, feed-water pumps and the erection of a new boiler room. The company also plans to erect a transmission line to supply electricity in Arlington, Partridge, Langdon and Turon; also one to supply Alden and another to supply Little River and Geneseo. W. E. Quillin is manager.

KANOPOLIS, KAN.—The installation of an electric generating unit in the municipal electric light plant and one 10-ton ice manufacturing plant is under consideration by the city of Kanopolis. John S. Holmquist is superintendent.

Southern States

BURLINGTON, N. C.—The Piedmont Power & Light Company contemplates the installation of a 3,000-kva. generator and the erection of an electric transmission line to Simpsonville, a distance of 4 miles. Junius H. Harden is vice-president and general manager.

NEWBERNE, N. C.—Contract has been placed for a 1,250-kw. turbine for the municipal electric light plant; also for the erection of new transmission lines and for panels to serve same. F. G. Godfrey is superintendent.

GREENVILLE, N. C. — The Water and Light Commission contemplates the installation of a new turbine and condenser in the municipal electric light plant. F. A. Haskins is acting superintendent.

SCOTLAND NECK, N. C. — Work will begin at once on the construction of an addition to the municipal electric light plant and erection of a brick chimney. New equipment will be installed, including a 500-kw. Curtis turbo-generator, a 250-hp. Keeler water-tube boiler, Wheeler condenser, spray-pond outfit, pumps, soot blowers, switchboard, etc., for which contracts have already been placed. Preparations are being made to sell energy to the town of Hobgood. L. R. Mills, Jr., is superintendent.

BAMBERG, S. C.—The commissioners of public works are planning to install a 125-kw. generator in the municipal electric light plant soon. J. G. Black is superintendent of distribution.

HUMBOLT, TENN. — The municipal water and light department contemplates the installation of a 500-kw. turbine in the municipal plant and the erection of 8 miles of transmission line. W. M. Case is manager.

SOMERVILLE, TENN.—The installation of a 25-hp. oil engine directly connected to a 37½-kw. generator in the municipal electric light plant is under consideration by the municipal water and light department. The proposed plans provide for the installation of another 25-hp. unit later. J. L. Sanders is superintendent.

SENATOBIA, MISS.—A new 125-kva. Westinghouse turbo-generator unit will be installed in the municipal electric light and water plant within the next thirty days. About 3 miles of transmission lines will be erected next summer. D. D. Funderburke is manager.

EUDORA, ARK.—L. M. Parkman, owner of the local electric light plant, contemplates extending his transmission system to some of the neighboring towns.

HARRISBURG, ARK.—The Harrisburg Electric Light & Power Company will install two 75-hp. oil engines and two 55-kw. generators. Machinery has already been purchased. J. A. Metz is manager.

SPRINGDALE, ARK.—The installation of a new street-lighting system is under consideration by the Springdale Light & Power Company. V. McDaniel of Fayetteville is secretary and manager.

WILMOT, ARK.—The Wilmot Light & Power Company contemplates extending its transmission line to Parkdale, 4 miles north of Wilmot, to supply energy there. Benjamin Wright is owner and manager.

AMITE, LA.—The Central Light & Power Company is now installing a 200-hp. Fairbanks oil engine and contemplates the installation of a series street-lighting system this spring. H. E. Burnham is treasurer and manager.

BASTROP, LA.—The municipal electric light and waterworks department contemplates the purchase of a 150-hp. natural-gas engine and a 100-kw. generator and extension of its present line. Cary Robertson is superintendent.

CLEVELAND, OKLA.—The property of the Oklahoma Utility Company has been purchased by A. A. Boyd of Michigan City, Ind. The new owner, it is understood, will rebuild the plant.

CROWDER, OKLA.—The Crowder Light Company is considering the installation of a 15-hp. engine and generator. A. Boiles is secretary and manager.

DURANT, OKLA.—The installation of a new 100-kva. generating unit in the municipal electric light plant is under consideration. J. D. Asbury is superintendent.

WAYNOKA, OKLA.—Extensions and improvements are contemplated to the municipal electric light plant, including the installation of a 75-kva., 60-cycle, 2,300-volt Fairbanks-Morse generator, type "Y" oil engine with equipment to connect three generators together, one regulator, ½ carload of 25-ft. poles, 1 mile of No. 8 weatherproof wire and fifty Westinghouse street series 110-volt incandescent lamps. It is not yet decided when contracts will be placed for the work. William Monfort is engineer in charge. M. M. Wright is electrician for the city.

WELEETKA, OKLA.—The Crystal Ice & Utilities Company contemplates doubling the capacity of its electric generating plant. C. A. Parrish is manager.

Pacific and Mountain States

SCIO, ORE.—The City Council contemplates the construction of a dam, flume and timber head gates, taking 47 second-ft. of water from Thomas Creek for a light, power and pumping plant. The cost is estimated at $38,427.

OAKLAND, CAL.—Plans are being prepared by the National Ice & Cold Storage Company, Postal Telegraph Building, San Francisco, for the construction of a plant on North First Street, to cost about $250,000.

OAKLAND, CAL.—The Strong & Scott Manufacturing Company, engineers, 413 South Third Street, Minneapolis, Minn., are preparing plans for a mill on the water front in Oakland for the Great Western Milling Company, Ninth and Alameda Streets, Los Angeles, to cost about $500,000.

SAN DIEGO, CAL.—Bids will soon be asked by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing and installing a complete power plant and generating equipment, including piping and accessories and distributing systems for electricity and steam at the Marine Corps base in San Diego. The cost is estimated at $150,000. A deposit of $10 will be required for plans and specifications.

STOCKTON, CAL.—New developments are contemplated by the Western States Gas & Electric Company on the south fork of the American River, a few miles above the company's present hydro-electric development, which will include the construction of a reservoir for impounding waters in the Twin Lakes, Echo and Medley Lakes, at the head of the south fork of the river. A 1,900-ft. fall of water will be utilized by a proposed hydro-electric plant, to develop 30,000 hp. The water after passing through the proposed plant and the present plant several miles down the American River will be used still farther down the stream for irrigation and domestic purposes.

Canada

MARYSVILLE, N. B.—Tenders are being received by the Canadian Cottons, Ltd., for a 5,000-kw. steam turbo-generator, with necessary switchboards, motors, etc., to supply electricity to operate its mills here. R. S. Kelsch, Power Building, Montreal, Que., is consulting engineer.

BRANTFORD, ONT.—Arrangements are being made to equip the old plant of the Brantford Motor Trucks for the manufacture of Bluebird electric appliances. Local capital amounting to $200,000 has been subscribed toward the project. J. B. Detweller, general manager of the local branch of the Steel Company of Canada, will be manager of the company.

WOODSTOCK, ONT.—The erection of a 13-000-volt substation and 1½ miles of 13,-000-volt transmission line to serve the west end of the city is under consideration by the Woodstock Water and Light Commission. J. G. Archibald is superintendent.

MAGOG, QUE.—The Dominion Textile Company is building a new dam for power development in connection with its large mills here. Two 1,500-kw. units will be installed. R. S. Kelsch, Power Building, Montreal, Que., is consulting engineer.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Feb. 11 for scrap-cutting machine, steam boilers, copper cable, brass, bronze, copper, lead, zinc, copper pipe, copper tubing, brass tubing, porthole glasses, etc. Blanks and further information relating to this circular (1,337) may be obtained from the above office.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Feb. 3 for construction of traveling crane, magnet wire, motor, switches, water coolers, etc. Blanks and information relating to this circular (1,333) may be obtained at the above office.

Record of Electrical Patents

Notes on United States Patents

(Issued Dec. 30, 1919)

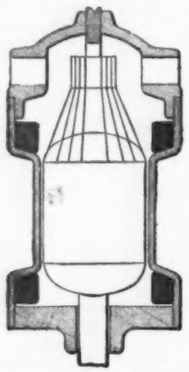
1,327,548. CONTROL OF POWER ABSORBED IN ELECTRIC FURNACES; Colin C. Gow and Donald F. Campbell, London, England. App. filed April 24, 1919. Power absorbed dependent upon the position of electrodes.

1,327,593. SERIES CONDENSER; William Dubilier, New York, N. Y. App. filed April 11, 1919. Condenser with variable terminal connections.

(Issued Jan. 13, 1920)

1,327,619. FIELD-MAGNET FRAME; Carl G. Koppitz, Greensburg, Pa. App. filed July 14, 1917. Consists of single piece.

1,327,622. CALLING MECHANISM FOR TELEPHONE EXCHANGES; Frank A. Lundquist, Chicago, Ill. App. filed March 11, 1918. Pneumatically operated keys for different numbers.



1,327,619—Field-Magnet Frame

1,327,642. ELECTRIC REGULATOR; Leonard Sykes, Fort Wayne, Ind. App. filed Jan. 18, 1918. Contact travels over resistance for increasing current supplied to lamp.

1,327,649. STORAGE-BATTERY JAR; Theodore A. Willard, East Cleveland, Ohio. App. filed Aug. 27, 1917. Minimum weight and size for given capacity.

1,327,650. STORAGE BATTERY ADAPTED PARTICULARLY FOR AEROPLANES; Theodore A. Willard, East Cleveland, Ohio. App. filed Aug. 27, 1917. Used upside down as on aeroplanes.

1,327,682. SWITCHBOARD FOR CHARGING STORAGE BATTERIES; Clarence E. Ogden, Cincinnati, Ohio. App. filed Sept. 9, 1918. Limits wastage.

1,327,736. PROCESS OF PRODUCING CARBIDE; James H. Reid, Newark, N. J. App. filed March 15, 1913. Resistance principle; economical and prolongs life of furnace.

1,327,737. PROCESS OF PROCURING AND SECURING PRODUCTS FROM CARBOHYDRATES; James H. Reid, Newark, N. J. App. filed Jan. 13, 1914. Successive stages of heat through resistance.

1,327,738. MEANS ACTUATED BY ALTERNATING ELECTRIC CURRENT FOR CONTROLLING OR OPERATING ELECTRIC FURNACES OR OTHER MECHANISMS; James H. Reid, Newark, N. J. App. filed Dec. 19, 1914. Alters distance between electrodes.

1,327,774. ELECTRIC WATER HEATER; Albert E. Plante, Montreal, Quebec, Can. App. filed June 2, 1919. Concentric electrodes inclosed in cylinder.

1,327,777. CIRCUIT INTERRUPTER; Karl C. Randall, Edgewood Park, Pa. App. filed Nov. 19, 1917. Overload trip and a current-limiting resistor with fuse for short-circuiting resistor.

1,327,784. SYSTEM OF CONTROL; Gerald F. Smith, Braddock Township, Allegheny County, Pa. App. filed Sept. 1, 1917. One motor utilized for exciting field windings of other machines during regenerative period.

1,327,787. MOTOR-CONTROLLER; William C. Stevens, Milwaukee, Wis. App. filed Sept. 6, 1917. Windings act cumulatively in starting and effect quick disengagement of main switch contacts for stopping.

1,327,789. SYSTEM OF CONTROL; Norman W. Storer, Pittsburgh, Pa. App. filed July 5, 1917. Electrical and mechanical braking for electric locomotives.

1,327,790. IGNITION SYSTEM; Horace V. S. Taylor, Pittsburgh, Pa. App. filed Jan. 5, 1916. Automatically opens primary circuit.

1,327,792. SPOT-WELDING APPARATUS; Frank Thornton, Jr., Mansfield, Ohio. App. filed April 18, 1919. Current both for compressive force and for heating.

1,327,795. SYSTEM OF CONTROL; Charles C. Whittaker, Wilkinsburg, Pa. App. filed June 19, 1917. Prevents slipping of wheels in regenerative systems for locomotives.

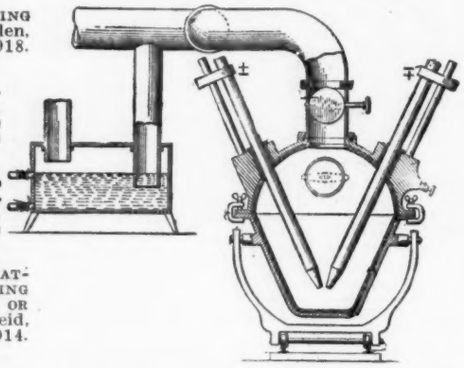
1,327,804. ELECTRICAL COMB; James M. Brooks, Washington, D. C. App. filed Aug. 25, 1919. Toothed dressing surface and an ironing surface.

1,327,805. AUTOMATIC TELEPHONE EXCHANGE; Albert M. Bullard, New York, N. Y. App. filed March 12, 1906. Selective switching for exchange with 10,000 lines.

1,327,814. METHOD OF AND APPARATUS FOR SPOT WELDING; Charles L. G. Fortescue, Pittsburgh, Pa. App. filed March 7, 1919. Welding current produces an electromagnetic force to compress articles when heated.

1,327,818. SIGNALING DEVICE; Irvin W. Gruhl, Los Angeles, Cal. App. filed Feb. 11, 1918. Manually or electrically operated projecting signal.

1,327,819. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Dec. 29, 1915. For parallel-connected direct-current regenerating machine.



1,327,737—Process of Procuring and Securing Products from Carbohydrates

1,327,820. DYNAMO-ELECTRIC MACHINE; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Jan. 10, 1916. Prevents sparking of single-phase commutator-type motor with distributed cross-field winding.

1,327,821. DYNAMO-ELECTRIC MACHINE; Rudolf E. Hellmund, Swissvale, Pa. App. filed Dec. 14, 1916. Protects insulation against destructive influences of vibration.

1,327,822. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed Jan. 16, 1917. Combination regenerative and automatic mechanical-braking system.

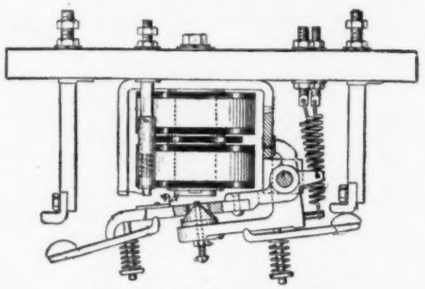
1,327,823. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed Jan. 16, 1917. Combination of electrical and mechanical-braking systems.

1,327,837. ELECTRICAL INDICATOR; Frederick A. Muschenheim and Frederick W. Blasdale, New York, N. Y. App. filed Jan. 12, 1918. Various signal indications for use by hotel clerks.

1,327,947. SYSTEM OF BONDING RAILS; Lawrence P. Crecelius, Cleveland, Ohio. App. filed April 10, 1914. Soft soldering bonds on to flat bond plates brazed to rail.

1,327,986. ELECTRIC HEATER; Charles E. Clark and Archie G. Dowell, San Francisco, Cal. App. filed Feb. 26, 1919. Uniformly distributed over large area surrounding heating structure.

1,327,989. GAS-METERING APPARATUS; Louis A. Ferguson, Evanston, Ill. App. filed Nov. 18, 1914. Records total gas consumption over long and short periods.



1,327,787—Motor Controller

1,328,027. DRY BATTERY; O. Sakizo, Tokyo, Japan. App. filed Jan. 30, 1919. Tight joint formed between seal and container wall.

1,328,032. INCUBATOR; Stanley C. Calow, Calgary, Alberta, Can. App. filed June 1, 1918. Heated electrically and automatically ventilated.

1,328,041. ELECTRIC RELAY AND THE LIKE; Kuno Fischer, Charlottenburg, Germany. App. filed Aug. 15, 1913. Protecting transmission lines or cables from electrical disturbances by ionization of gas gap through high-frequency currents.

1,328,068. ELECTRICALLY HEATED HUMIDIFIER; Daniel H. Young, Manchester, Iowa. App. filed May 22, 1919. Obviates excessive initial reaction.

1,328,069. ELECTROTHERMOGENIC DEVICE FOR HUMIDIFIERS; Daniel H. Young, Manchester, Iowa. App. filed May 22, 1919. Special electrodes for rapid vaporization.

1,328,083. SPEED TRANSFORMER; Maximilian M. Goldberg, Dayton, Ohio. App. filed Nov. 4, 1915. Direction of rotation of driven member reversed without changing speed of driving device.

1,328,126. ELECTRIC CONTROLLER; Theodore T. Cater, Aurora, Mo. App. filed Feb. 15, 1919. Provides time-regulated automatic cut-off.

1,328,149. AUTOMATIC VOLTAGE CONTROL; William S. Harley, Milwaukee, Wis. App. filed Sept. 19, 1917. Generator voltage constant irrespective of speed of motorcycle engine.

1,328,187. DEVICE FOR INDICATING MAGNETIC POLARITY; Henry D. Oakley, Syracuse, N. Y. App. filed July 6, 1916. Trouble shooting on motors and generators.

1,328,224. RECEPTACLE; Reuben B. Benjamin, Chicago, Ill. App. filed April 1, 1915. Electrical contacts effectively insulated.

1,328,229. ELECTRIC HEATING UNIT; Frank W. Hewitt, Arlington, Mass. App. filed May 13, 1918. Bath mats and heating pads for therapeutics.

1,328,245. SIGNAL INDICATOR AND RECORDER; Frederick Liebler, New York, N. Y. App. filed Aug. 5, 1912. Solenoid-operated automobile signal.

1,328,247. ELECTRIC CLOCK SYSTEM; Arthur F. Poole, Chicago, Ill. App. filed Sept. 10, 1917. Secondary clocks continue to run when current supply is temporarily cut off.